ChemRisk/Shonka Research Associates, Inc., Document Request Form

2597

(This section to be completed by subcontractor requesting document)

J. Lamb / 1034A

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This document consists of 5 pages
No. 3 of 7 copies, Series A.

UNION CARBIDE

INTERNAL CORRESPONDENCE

ORGDP
CHEM. DIV.
JD JMY
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SEP 20 1960
UCNC
3880

UNION CARBIDE NUCLEAR COMPANY

POST OFFICE BOX P OAK RIDGE, TENNESSEE

PLANT RECORDS DEPT.
CENTRAL FILES
REC. M-20648
FILE
X-REF.
X-REF.

To Name: Mr. R. J. Clouse
Company: K-1420
Location:

Date: September 16, 1960

Originating Dept: Chemical Engineering

Answering letter date:

Copy to: Mr. J. W. Arendt
Mr. E. C. Bollinger
Mr. J. Dykstra
Mr. J. A. Parsons
Mr. M. F. Schwenn
File

KP 2040 3 A
KP 2040 3 A

Subject: K-1420 Incinerator Ash
Uranium Recovery

KP-2040

This document has been approved for release to the public by: C. A. Squires 26 Sept 94
Technical Information Officer Date
Oak Ridge K-25 Site

As requested, an evaluation has been made of the problems associated with the accumulation of incinerator ash and the recovery of uranium contained in the ash. The purpose of this evaluation was not only to determine the most suitable method for recovery of uranium from the present accumulation of incinerator ash, but also to audit the source of contaminated combustible material with the idea of trying to decrease the quantity of material which would have to be processed in the future. The current accumulation rate of incinerator ash at K-1420 is approximately 1800 pounds per month while the present inventory is in excess of 15,000 pounds as shown in table 1.

Summary

1. No major reduction in the quantity of combustible contaminated scrap is evident for the immediate future. Minor reductions could result from the addition of new administrative controls in some areas of the plant.

2. Since the primary problem involved in the recovery of uranium from K-1420 incinerator ash is the presence of elemental carbon in the ash, it is suggested that calcining equipment of nuclearly-safe dimensions be purchased. The redesign of the present incinerator may provide an alternate method for eliminating the carbon.

Discussion

With respect to the source of combustible scrap at ORGDP, the following analysis was developed:

K-1420 - Approximately 60% of the total combustible scrap is generated within the K-1420 building. This consists of contaminated wrapping paper which is removed from equipment scheduled for cleaning, rags and sponges, and burnable floor sweeping compound.

Union Carbide Nuclear Company, Oak Ridge Gaseous Diffusion Plant, Operating Contractor for the U.S.
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UCN-882
(11-3-60)

K-1131, K-1410, K-413 - Approximately 30% of the total combustible scrap originates from the feed plant or auxiliary operations of the feed plant. Again, wrapping paper, rags, floor sweepings, and burnable filter units (Edgewood Arsenal type) comprise the bulk of the material.

Cascade, etc. - The remaining 10% of combustible scrap originates in minor quantities throughout the cascade, laboratory, and K-1413 pilot plant.

The incinerator at K-1420 is also utilized to burn quantities of contaminated hydrocarbon oil and records in the form of circular and roll instrument charts. Neither of these items add to the problem, since the contaminated oil is insignificant in quantity and is burned in a separate furnace. Present operating instructions at K-1420 require that the non-contaminated records be burned separately, so that the ashes can be disposed of through the normal channels set up for non-contaminated scrap.

In view of the findings listed above, the following conclusions and recommendations are presented:

1. No major reduction in the quantity of combustible contaminated scrap can be expected in the near future.

2. Increased administrative controls in some areas could result in minor reductions, such as

   a) Floor sweeping compound from K-1131, K-413, and K-1410 could probably be dumped into the non-contaminated disposal containers, providing operational controls prevented the use of floor sweeping compound on extensive uranium spills in these areas.

   b) In K-1420 and other areas, where wrapping paper is used to wrap contaminated equipment, the paper should be thoroughly vacuum cleaned prior to burning. If strict controls were maintained here it may be possible to discard significant quantities of ash which would not be economically recoverable. (It should be noted that the practice of pre-vacuum cleaning is one of the nuclear hazards requirements as specified in approval letter KSA-23, January 20, 1956.)

Recovery

The currently used nuclearly-safe processing equipment at K-1420 is not suitable for the recovery of uranium from incinerator ash without modifications and additional equipment. The primary problem concerns the presence of elemental carbon in the ash. No particular problems are associated with the dissolving step (nitric acid, nuclearly-safe column dissolver); however, the relatively high content of elemental carbon in the dissolver solution is difficult to remove utilizing the existing continuous centrifuges. As exhibited

by the Chemical Division, if the carbon is not removed prior to the uranium extraction step, the extraction efficiency is significantly decreased by the formation of extensive emulsions in the columns. So the real problem is to either eliminate the carbon by more complete oxidation of the ash prior to uranium processing, or to remove the carbon from the dissolver solution prior to the extraction step. Several possible approaches to the problem are discussed.

In regard to the present inventory of material, consideration was given to batch processing, that is, batch sizes would be governed by nuclear safety criteria. Batch processing would permit the use of "geometrically-unsafe" dissolving and filtering equipment for separation of the carbon from dissolver solution. Prior to the installation of the continuous dissolver system in K-1420, batch dissolution was the accepted method. However, during the past two or three years, DP DP has spent considerable effort and money to revise the procedures and equipment to store, transport, and process uranium-bearing materials in nuclearly-safe equipment and containers. In view of this philosophy, it does not seem reasonable to revert to the batch-type operation.

Separation of elemental carbon from the ash by air classification was also considered. As a preliminary step, samples of ash were analyzed for particle size distribution by the Process Control Laboratory. Each sieve fraction was analyzed for uranium with results shown in the attached table 2. Results show a break in particle size and uranium concentration at the 200 mesh screen size. From a uranium recovery standpoint, however, there would be no advantage in utilizing a screening operation (or air classification) since results indicate that only 60% of the total uranium is present in 70% of the total bulk of ash.

The most direct approach to this problem is to eliminate the presence of elemental carbon in the ash during the combustion of the original contaminated scrap. In order to accomplish this, combustion temperatures in the range of 1800°F. or greater would be necessary. The existing K-1420 incinerator is designed as a high capacity, low temperature unit and is not suitable for high temperature operation. Redesign of the present incinerator should also be considered. However, a commercial unit could be obtained for use in conjunction with the existing incinerator which would do the job. The Chemical Division has already received preliminary information on such a unit from Plant Engineering. Although a larger unit would be necessary (> 5 pounds per hour), this unit would be a nuclearly-safe, continuous-type rotary calciner with a capacity of 2.5 to 3 pounds of ash per hour.

Firm installation costs are not available: however, it is estimated that $40,000 would cover the complete installation. Justification for this size expenditure does not appear to be a problem when the value of the uranium to be recovered is in the order of $160,000 with an additional $10,000 per month being accumulated. Savings resulting from a reduction in storage and handling

costs of incinerator ash can also be considered. Current accumulations are being packaged in nuclearly-safe containers and stored in the Coded Chemical Department's vaults. If equipment were provided in K-1220 to process the ash on a current basis, such handling and storage costs would be eliminated.

All things considered, it is suggested that the latter approach discussed above be expeditiously pursued by the Chemical Division. Urgency in this matter is noted because of the necessity for additional storage space in the near future and the fact that we do not foresee a significant reduction in the accumulation rate of incinerator ash.

A. L. Allen

Approved: J. A. Parsons

ALA:vtd

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TABLE 1

INCINERATOR ASH INVENTORY

Assay Range	Quantity, Pounds	Kgs. U	Kgs. U-235	U Value, $
8 (0.83%)	1,384	361.4	3.00	13,000
9 (1.26%)	4,274	380.5	4.80	28,900
10 (2.45%)	5,988	322.8	7.90	61,300
11 (3.94%)	1,505	32.6	1.28	11,400
12 (6.57%)	1,380	40.6	2.67	26,400
13 (11.8%)	443	8.3	0.98	10,200
14 (18.5%)	145	1.6	0.29	3,100
15 (20.9%)	129	2.9	0.61	6,400
Total	15,248	1,150.7	21.53	160,700

TABLE 2

SCREEN ANALYSIS - INCINERATOR ASH

Screen Size, Mesh	Retained, Wt.%	U Conc. of Fraction, % U	% of Total Uranium in Each Fraction
+ 40	8.33	47.1	23.3
+ 80	10.09	16.5	9.9
+200	14.04	9.1	7.6
+325	63.16	14.7	55.1
-325	4.39	15.7	4.1

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J. Lamb / 1034A

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JCN-428
(1-1-59)

Chem. Engr.

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ORDS - Rec'd 2/1/60

UNION CARBIDE INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX P, OAK RIDGE, TENNESSEE

To (Name) Mr. A. Varlan
Company
Location K-1420

Date June 1, 1960

Originating Dept. Production Engineering

Answering letter date

Subject Economic Study of the Recovery of Uranium From Contaminated Materials

KP-1966

Copy to
Mr. A. L. Allen
Mr. J. W. Arendt
Mr. R. J. Clouse
Mr. H. J. Culbert
Mr. W. D. McCluen
Mr. J. A. Parsons
Mr. S. S. Stief
Dr. C. W. Weber
Production Division Central File
File

This document has been approved for release to the public by:
Technical Information Officer
Oak Ridge K-25 Site
Date 6/14/96

An economic study was made of the recovery of uranium in nine uranium-bearing materials that were not feasible to process prior to the installation of the geometrically safe dissolver in K-1420. Results show that an estimated $98,500 worth of uranium of all assays can be recovered for approximately $46,500, thus gaining approximately $52,000.

From this study, it is recommended that those materials showing an economic recovery value be processed. Miscellaneous filter cake material should be discarded because the value of the contained uranium is less than the expected processing cost.

Table 1, summarizing the study, shows that materials such as soda lime and/or salt, laboratory waste solutions, chloride solutions, and sodium fluoride pellets can be processed through the geometrically safe dissolver without any expenditure for additional equipment. These materials can be processed by "blending" with alumina to complex both the chloride and fluoride ion. Processing of MFL filter cake and trichlorethylene prior to dissolution of the uranium-bearing solids in the dissolver would require an estimated $9,000 for additional equipment, as proposed in figure 1. Similarly, processing filterings and undissolved filterings would require an estimated $7,000 for new equipment assuming that the concentration of chloride would be high enough to necessitate batch handling in special equipment resistant to chlorides or chlorine, as proposed in figure 2.

Union Carbide Nuclear Company, Oak Ridge Gaseous Diffusion Plant, Operating Contractor for the U.S. Atomic Energy Commission.

Classification changed to UNCLASSIFIED (level and category)

Thomas W. Sellers 9/23/94
ADO or ADO signature (first reviewer) Date

Sam W. Wohlfort 9/30/94
ADO signature (final reviewer) Date

NOT [illegible] FROM PLANT RECORDS K-1034

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The study indicated that miscellaneous filter cake is uneconomical to process because less than 1 percent of the total uranium content of 270 kilograms has an assay of greater than 0.96 and, therefore, a low dollar value. This material is a lime-uranium mixture having a semi-fluid composition corresponding to mud. Thus, an additional cost is incurred since an extra steam sparging step is required to fluidize the mud sufficiently to transfer it from the original containers to the dissolver.

Dr. C. W. Weber and Mr. O. H. Howard of the Technical Division state that a literature survey[1], concerning the corrosiveness of nitric acid containing chlorides in stainless steel, states that boiling nitric acid with 350 ppm chlorides was found acceptable for stainless steel even with no aluminum ion added. They have also duplicated the results of Mr. H. J. Culbert of Process Engineering in determining that a 2 molar ratio of aluminum ion to chloride ion is required to complex both the fluoride and chloride ion. In a meeting on May 25, 1960, with Messrs. Clouse, Allen, Paluzelle, Culbert, Weber, and Howard, it was agreed that soda lime and/or salt, laboratory waste solutions, chloride solutions, and sodium fluoride pellets, would be blended into the processing of alumina in such a ratio that the chloride and fluoride ions will be complexed. These ratios are given as:

1 gram Al ion per gram chloride ion
and 1.4 gram Al ion per gram fluoride ion

which are equivalent to:

1.9 grams alumina (Al_2O_3) per gram chloride ion
2.6 grams alumina per gram fluoride ion.

In the case of sodium fluoride pellets, a minimum of 260 pounds of alumina should be blended with every 100 pounds of sodium fluoride. To determine the approximate chloride content, a quick and fairly accurate analysis of incoming materials suspected of containing chlorides will be made by Process Laboratory personnel. From the analyses, the ratios of alumina to chloride bearing material can be made.

Filterings and undissolved filterings were regarded as a single item for simplification. These materials consist of almost anything non-combustible, such as earth, pieces of glass, metal, wire, etc. A laboratory experiment to leach out the uranium with boiling 60 percent nitric acid removed approximately half of the contained uranium. Analysis of the residue was made using aqua regia (3 parts HCl and 1 part HNO_3), and therefore it is assumed that this powerful oxidizing agent would have to be used on the larger scale. It is also assumed that the residual chloride content would be excessively high for complexing with aluminum ion and that a potassium permanganate treatment, as developed by Dr. Weber and associates, would have to be used. Processing costs are estimated to be unusually high because of a small batch digestion step requiring safe geometry equipment.

1/ Review of the Maximum Allowable Chloride Concentration in the Proposed Darex Pilot Plant Product, J. M. Holmes, ORNL (CF-59-1-137)

The MFL filter cake and trichlorethylene require additional equipment upstream of the dissolver so that the solids may be separated and washed from any oily matter. It is important from a safety standpoint not to have any oil or solvent present in the solids before entering the dissolver. (Nitration of organics can result in explosive compounds.) MFL filter cake should be cut or shredded before being agitated with a solvent to improve contact area. Where solvents are used, adequate venting and, in most cases, explosion proof motors for electrically driven equipment must be used.. The solvent for removing MFL oil can be trichlorofluoromethane (Freon-11, expensive), acetone (explosive), carbon tetrachloride (toxic), and trichloroethylene (toxic) in decreasing order of effectiveness. Batchwise processing in geometrically safe equipment results in a high cost.

R. Palmzelle

R. Palmzelle

RP:jc

TABLE 1

ESTIMATED COSTS TO RECOVER URANIUM FROM CONTAMINATED MATERIALS

Material	Amount in Inventory	Contained U, Kg.	Value of U, $	Cost to Recover, $	New Equipment Cost, $	Total Cost, $	Estimated Gain, $
1. Soda Lime and/or Salt	1,470	65.1	18,442	1,430	0	1,430	17,012
2. Lab. Waste Solution	5,110 gal.	198.9	6,000	2,190	0	2,190	3,810
3. Chloride Solutions	1,715 gal.	71.0	7,700	736	0	736	6,964
4. Misc. Filter Cake	4,614	270.1	3,998	5,490	0	5,490	(-1,492)
5. MFL Filter Cake	2,931	128.4	26,835	5,000	9,000	14,000	12,835
6. Trichloroethylene	500 gal.	33.0	2,551	1,460	0	1,460	1,091
7. Filterings	787	43.0	676	18,800	7,000	25,800	1,523
8. Undissolved Filterings	9,267	235.6	26,647				
9. Sodium Fluoride	875	35.6	9,644	830	0	830	8,814
TOTALS		810.6	98,495	30,446	16,000	46,446	52,049

Note: Totals do not include miscellaneous filter cake, Item 4.

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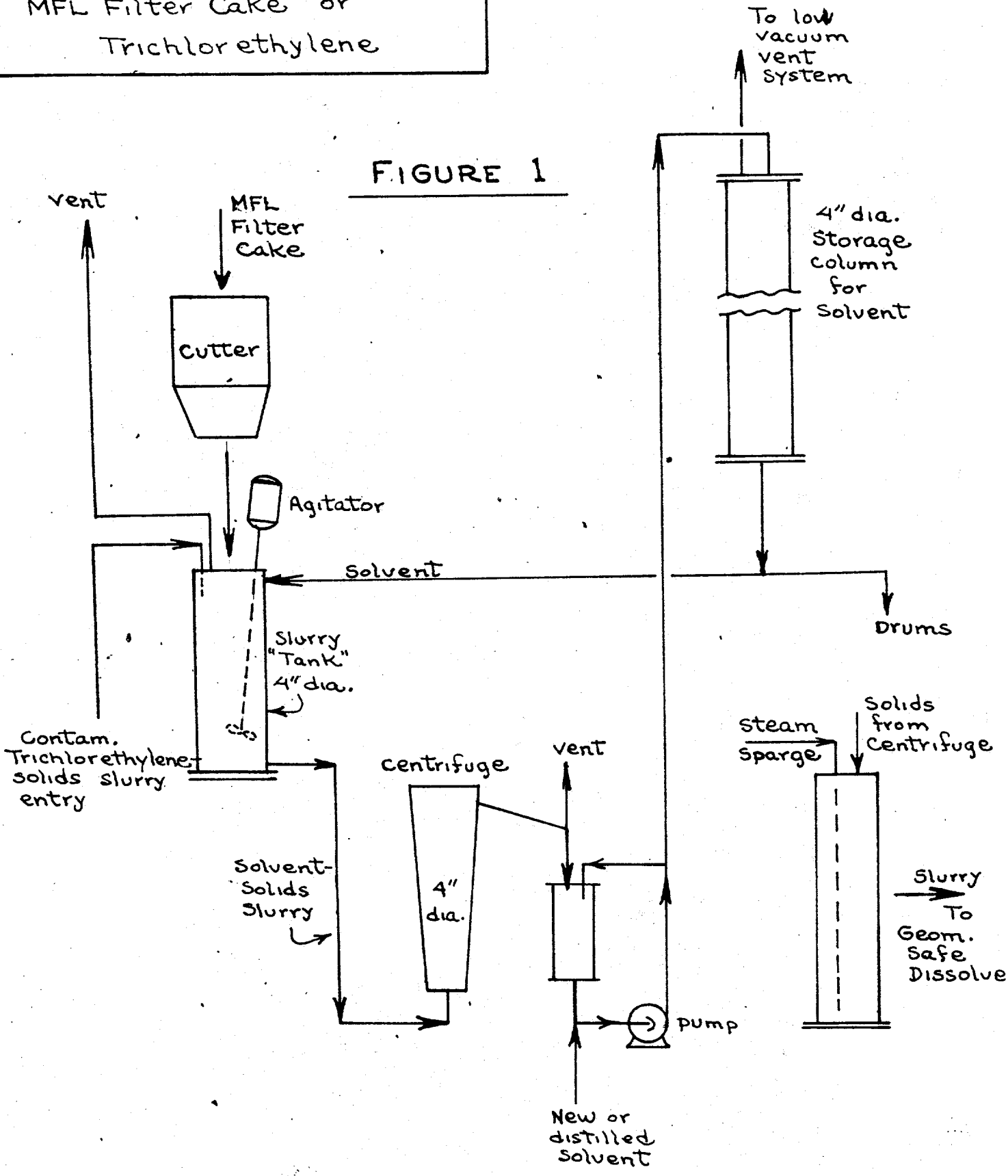
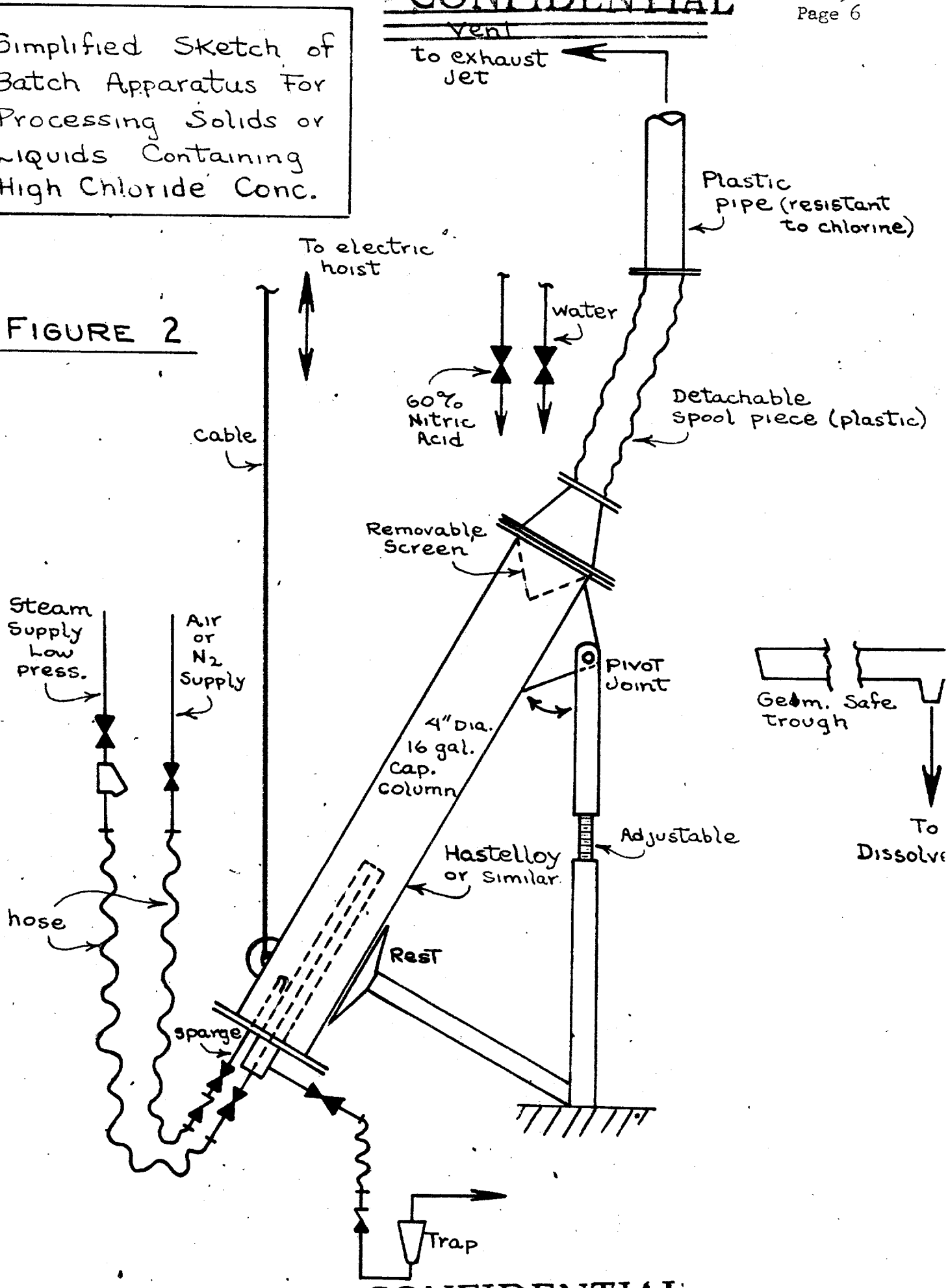
Flow Diagram of Batch Apparatus For Processing MFL Filter Cake or Trichlorethylene

FIGURE 1



Simplified Sketch of Batch Apparatus For Processing Solids or Liquids Containing High Chloride Conc.

FIGURE 2



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INTER-COMPANY CORRESPONDENCE

K-96515

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

Folder B Date 6-1-55

TO Mr. J. A. Marshall
LOCATION K-303-7

DATE November 23, 1954

ANSWERING LETTER DATE

ATTENTION

COPY TO Mr. A. L. Allen, Mr. J. W. Arendt, Mr. R. M. Batch, Mr. E. C. Bollinger, Dr. A. D. Callihan, Mr. J. Dykstra, Mr. L. B. Emlet, Dr. G. A. Garrett, Dr. H. F. Henry-K25RC, Mr. A. P. Huber, Mr. R. G. Jordan, Mr. D. M. Lang, Dr. R. L. Macklin, Mr. J. A. Parsons, Mr. W. L. Richardson, Mr. M. F. Schwenn, Mr. H. G. P. Snyder, Mr. E. O. Sternberg, Mr. B. H. Thompson

SUBJECT K-1303 and K-1301 Decontamination and Recovery Facilities

KS-458

M-5982

This document has been approved for release to the public by: A. S. Quist 6 May 55 Technical Information Officer Oak Ridge K-25 Site

KS 458 10 A *KS 458 10 A*

The attached tabular summary and equipment location diagrams outline our understanding of the provisions of the criticality approval letters which have been issued for the K-1303 and K-1301 uranium decontamination and recovery facilities, and thus indicate the current status of the operation and equipment controls for nuclear safety in these areas. This summary will be issued annually and will include new installations, equipment revisions, operational changes, and specified controls for the prevention of a criticality reaction as indicated in the respective approval letters issued during the year.

The principal items of equipment have been designed within the K-25 concepts of "safe" geometry for product assay uranium,[1] and all components, including units moving along predetermined paths, are spaced to meet the interaction solid angle limitation of 1.0 steradian. However, those miscellaneous operations which may require the use of unsafe containers for uranium storage or transfer purposes are based on known "safe" quantities according to uranium analysis data.

Please advise if equipment locations or other information given herein are not in agreement with existing operations.

Carbide and Carbon Chemicals Corporation Operating Contractor for the U.S. Atomic Energy Commission.

RECEIVED DEC 3 1954 SAFETY, FIRE, AND RADIATION CONTROL

K25RC PLANT RECORDS NOT TO BE REMOVED FROM

HFH:WAJ:vr

APPROVAL COMMITTEE ON RADIATION HAZARDS

A. D. Callihan — G. A. Garrett — H. F. Henry — R. L. Macklin

1. Henry, H. F., Mallett, A. J., Newlon, C. E., and Rohr, R. C., Basic Critical Mass Information and its Application to K-25 Design and Operation, (First Revision, 6-8-53, (K-1019)

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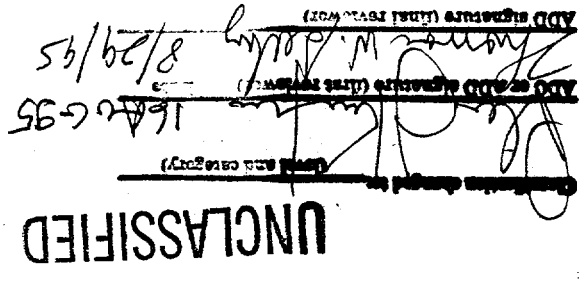
Classification changed to Unclassified
(Level and Category)

K-25 Classification Office

By Authority of J.W. Selby 8/29/95
Date

By E B McCaskill 2/20/96
(Signature of Person Making Change) Date

Verified by Roland P. Prince 2/20/96
(Signature of Person Verifying Change) Date



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DECONTAMINATION AND RECOVERY FACILITIES - K-1303

COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY: DESIGN CYL.	DESIGN SLAB	DESIGN VOL.	OPERATIONAL LIMITS MASS	OPERATIONAL LIMITS ASSAY	OPERATIONAL LIMITS CONC.	OPERATIONAL CONTROLS
I. Converter Decontamination Facilities									I. Converter Decontamination Facilities
A. Acid Spray System KZ-1692 KS-20	Decontamination of converters by a recirculated nitric acid spray.	8' x 7' x 11' high spray booth with 1.5" slab depth controlled by a liquid level regulator. Free drainage is provided for the plenum chamber.		x					A. Acid Spray System 1. Converters are dismantled, inspected, and excess uranium solids are removed by safe vacuum cleaner before spray cleaning.
		Centrifugal pump.		x					2. Equipment containing abnormal deposits not removable by vacuum cleaning is set aside for further consideration.
		600 liter volume storage loop consisting of 180' of 5" I.D. "U" shaped steam-heated piping with safe insulation.	x						3. The liquid level cut-off switch for the spray pump is checked weekly for control of safe slab depth in the spray booth.
		600 liter volume spare loop (same as above but used either for acid or water rinse solution. Note Item B below.)	x						4. Equipment is so positioned in the spray booth as to prevent holdup of solution.
									5. No uranium containers are stored within 10' of the storage loop.
B. Water Rinse Spray System KZ-1692 KS-20	Water rinse of equipment items previously cleaned in the acid spray booth.	Similar to that of acid spray system (Part A) but also including three 55-gal. drums for temporary storage of specified rinse loop solution.	(See above.)				x	x	B. Water Rinse Spray System The operational controls for this unit are the same as that specified for the acid spray system. (Note Part A.) See Item C for specified drum usage.
C. Rinse Loop Evaporator KS-385, KS-198, KS-43	Concentration of dilute uranium solution from the rinse loop.	48" dia. steam-heated evaporator with 1.5" slab depth controlled by an overflow.		x					C. Rinse Loop Evaporator 1. Evaporator concentrate is routinely collected in "always-safe" containers which are then adequately spaced in the yard storage area.
		5" I.D. collector cylinders	x						
		55-gal. drums for storage of evaporator concentrate.					x	x	

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COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY						OPERATIONAL CONTROLS
			DESIGN			OPERATIONAL LIMITS			
			CYL.	SLAB	VOL.	MASS	ASSAY	CONC.	
I. C. Rinse Loop Evaporator (Cont'd.)									C. Rinse Loop Evaporator (Cont'd.) 2. The evaporator is flushed with acid solution between assay changes and the solution collected in "always-safe" containers. 3. The spare storage loop is isolated from the system during this operation. 4. a. In specific cases, based on an evaporator concentration factor of 40, evaporator concentrate is transferred to a 55-gal. drum on a "safe" mass basis predetermined by loop concentration and assay. Loop Concentration — U-235 Assay Limit 0-500 ppm. U — 10.0% 500-1000 ppm. U — 6.0% 1000-1500 ppm. U — 4.3% b. Storage drums are checked for material holdup. c. Drums are spaced at least 10' from the evaporator or from each other.
II. Uranium Recovery									II. Uranium Recovery
A. Carbitol Extraction Process KS-391, KS-129, KS-127, KS-83, KS-5	Removal of uranium from the uranium-acid solution by a solvent extraction process.	2 - 3" dia. x 11" filter units in the feed line from the acid loop.	x						A. Carbitol Extraction Process 1. The free volume of the proportioning pump is reduced by paraffin for safe volume control.
		5" I.D. x 3' carbitol and uranium-acid solution mixing tank. (1st mixer)	x						
		5" I.D. x 10' carbitol and uranium-acid separation tube. (1st separator)	x						

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COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY: DESIGN CYL.	DESIGN SLAB	DESIGN VOL.	OPERATIONAL LIMITS MASS	OPERATIONAL LIMITS ASSAY	OPERATIONAL LIMITS CONC.	OPERATIONAL CONTROLS
II. A. Carbitol Extraction Process (Cont'd.)		out 5" I.D. x 3' carbitol-water mixing tank. (2nd mixer)	x						A. Carbitol Extraction Process (Cont'd.)
		out 5" I.D. x 10' carbitol-water separation tube. (2nd separator)	x						2. Carbitol which collects in the decanters is drained to safe containers, transferred along specified routes, and returned to the system through the extended vent on the first horizontal separator tube. (See attached sketch.)
		out 5" I.D. x 10' uranium-water storage tower.	x						
		out Proportioning reciprocating pump.			x				3. In special cases, uranyl nitrate solutions may be stored in 55-gal. drums on a "safe" U-235 mass basis in the event of product evaporator shutdown or failure provided:
		out 3 small centrifugal pumps.		x					
		3 - 4" I.D. x 5' carbitol decanters.	x						a. The acid loop volume does not exceed 600 liters and is circulated for 30 minutes before sampling.
		55-gal. storage drums.					x	x	b. Uranium concentration in the carbitol is reduced to less than 2000 ppm. before a batch extraction.
									c. "Safe" U-235 quantities are determined as follows:
									Acid Loop Concentrations - ppm. / Safe U-235 Assay: 3000 - 5000 / 11%; 1000 - 3000 / 17%; 0 - 1000 / 40%
B. Product Evaporator KS-43, KS-20, KS-5	Concentration of uranium solution from the recovery system by an evaporation process.	40" I.D. steam-heated evaporator with 1.5" slab depth controlled by an overflow; this includes an overflow alarm system.		x					B. Product Evaporator
		Centrifugal pump.		x					1. Uranium containers are maintained at least 8' from the evaporator.
		5" I.D. overflow container and a 5" I.D. transfer container.	x						2. Overflow solution is collected in a "safe" container.

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COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY DESIGN CYL.	DESIGN SLAB	DESIGN VOL.	OPERATIONAL LIMITS MASS	OPERATIONAL LIMITS ASSAY	OPERATIONAL LIMITS CONC.	OPERATIONAL CONTROLS
C. Steam Drier KS-43, KS-38 KS-20, KS-5	Further concentration of the evaporator product to a nearly anhydrous uranyl nitrate solution.	A 6' section of concentric 4" I.D. and 5" I.D. piping. Steam is passed through the annulus.	x						C. Steam Drier 1. The spacing requirements are the same as that specified for the evaporator. (See Item II-B.) 2. At no time is the steam condensate line from the drier to be connected to the 6" drain line. (See Item II-D.)
		4" I.D. x 30" collector cylinder positioned on dolly beneath the drier.	x						
D. 6" I.D. Condensate Drain Line KS-38	Transfer to the holding pond of evaporator condensate, pump cooling water, and water from final rinse of decontaminated equipment.	6" I.D. vitreous clay pipe line. Vent lines are provided to permit escape of solution in the event of a line plug.						x	D. 6" I.D. Condensate Drain Line 1. A minimum water flow of approximately 1000 gph. is maintained for solution dilution in the event of equipment rupture and to indicate plugging of the line. 2. Spot checks are made of evaporator condensate to control the uranium concentration within discard limits. 3. Other solutions are [illegible]tied into the drain line only [illegible]alyses indicate the concentr[illegible]n is within uranium accoun[illegible]ility discard limits.
E. U_3O_8 Conversion Furnace (Cubicles No. 12 and No. 11) KS-34	Conversion to the oxide by thermal decomposition of uranyl nitrate from the steam drier.	4" I.D. x 30" reactors positioned in either a 5" I.D. furnace or an adjacent rectangular Hoskins furnace.	x						E. U_3O_8 Conversion Furnace 1. Specified routes are followed in the transfer of reactors: a. Through hallway only when there are no contaminated converters in storage; otherwise eastward around building along the north or south corridors. b. Cylinders in transit are maintained at least 4' from other uranium containers. 2. Only one reactor is in each cubicle at a time.
		4" I.D. x 5' glass vent gas scrubber - located in adjacent Cubicle No. 11.	x						
		4" I.D. trap provided in the reactor vent line to prevent backup of scrubber solution into the reactor upon cooling.	x						

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DECONTAMINATION AND RECOVERY FACILITIES - K-1303

COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY						OPERATIONAL CONTROL
			DESIGN			OPERATIONAL LIMITS			
			CYL.	SLAB	VOL.	MASS	ASSAY	CONC.	
III. Miscellaneous Operations									III. Miscellaneous Operations
A. Coolant Recovery Unit KS-312	Water extraction of uranium from contaminated C_8F_{16} coolant. (The resultant uranium-water solution is charged to the acid loop and then processed through the uranium recovery system. See Item II.)	Uranium recovery equipment.	(See Item II. A, B, & C.)						A. Coolant Recovery Unit 1. The unit is operated on a "safe" U-235 mass basis when unsafe containers are used for the storage of uranium solution. 2. Uranium containers are properly identified and adequately spaced in yard storage area. 3. The converter decontamination operations are discontinued during this operation. 4. "Safe" storage containers are used if batch limits are exceeded.
		5" I.D. cylinders	x						
		30 or 55-gal. drums for storage of reclaimed coolant.				x			
B. 1. Recovery of Uranium from contaminated MFL oil. (Cubicle No. 6) KS-273, KS-233	Filtration of oils to form filter cakes for uranium recovery.	Two 10" I.D. x 18" reactor kettles.				x			B. 1. Recovery of Uranium from Contaminated MFL Oil The operation is on a safe U-235 mass basis as determined by chemical analysis of the oil with 10% allowance for error in sampling and analysis.
		Two 10" I.D. air-pressured filter presses.				x			
		5-gal. containers.				x			
2. MFL Filter Cake Dissolver KS-273, KS-129	Dissolving MFL filter cake in nitric acid and subsequent uranium recovery in existing recovery equipment. (See Item II.)	2' I.D. x 34" dissolver tank.				x			2. MFL Filter Cake Dissolver a. The unit is operated on a "safe" U-235 mass basis. (See Item III-B-1.) b. A minimum spacing of 8' is maintained between a batch and other uranium containers. c. The north entrance is used for transfer of filter cake into recovery room.
		8" I.D. x 3' air-pressured filter.				x			
		The equipment items are positioned in the dismantling booth during use and are removed after the operation is completed.							

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DECONTAMINATION AND RECOVERY FACILITIES - K-1303

COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY						OPERATIONAL CONTROLS
			DESIGN			OPERATIONAL LIMITS			
			CYL.	SLAB	VOL.	MASS	ASSAY	CONC.	
III. B. 2. MFL Filter Cake Dissolver (Cont'd)									III. B. 2. MFL Filter Cake Dissolver (Cont'd) d. The operation is discontinued when converter decontamination is in progress.
IV. The following operations have been discontinued; however, some or all of the equipment for each operation is in standby condition.									
A. Spray Drier Unit (Cubicle No. 3) KS-172, KS-150	Thermal decomposition of uranyl nitrate solution from the product evaporator to dry uranyl oxide.	5" I.D. x 36" electrically-heated stainless steel spray drier equipped with geometrically unsafe insulation.	x						A. Spray Drier Unit 1. The following precautions are taken to prevent wetting of the unsafe spray drier insulation: a. The feed supply to the drier is cut off automatically upon loss of drier temperature during operation, and the manual valve in the feed line is closed and stop-tagged during shutdown. b. Water is fed to the exhaust gas scrubber only when the scrubber is isolated from the drier feed line. 2. Reactors in transit are maintained at least 5' from other uranium-bearing containers. 3. No other uranium materials are stored in the cubicle.
		4" I.D. x 30" reactor collector cylinder enclosed in a housing with safe insulation.	x						
		5" I.D. x 10'7" stainless steel vent gas scrubber.	x						
		Centrifugal pump.		x					
		Automatic temperature controls.							
B. ClF_3 Distillation Column (Cubicle No. 1) KS-112	Experimental separation of UF_6 from UF_6-ClF_3 mixtures.	1" I.D. x 5'9" distillation column.	x						B. ClF_3 Distillation Column 1. Not more than 5 cylinders are in the cubicle at one time and all are in designated storage positions. 2. Cylinders are moved singly. 3. The distillation system is empty when material is transferred from a removal cylinder to a collector cylinder.
		4" I.D. x 5" electrically-heated stillpot.	x						
		4" I.D. x 12" feed cylinders.	x						
		2" I.D. x 6" product cylinders.	x						
		4" I.D. x 6½" removal cylinders.	x						

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COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY: DESIGN CYL.	DESIGN SLAB	DESIGN VOL.	OPERATIONAL LIMITS MASS	OPERATIONAL LIMITS ASSAY	OPERATIONAL LIMITS CONC.	OPERATIONAL CONTROLS
IV. B. ClF_3 Distillation Column (Cont'd)									IV. B. ClF_3 Distillation Column (Cont'd) 4. Other uranium containers are not stored or passed within 4' of the cubicle.
C. Sampling Unit (Cubicle No. 9) KS-152, KS-123	Sampling of cylinders containing UF_6-ClF_3 mixtures.	2" I.D. chemical traps.	x						C. Sampling Unit 1. Not more than 2 cylinders are in the cubicle at one time. 2. Cylinders are moved singly.
		Vacuum pump.			x				
		4" I.D. and 5" I.D. cylinders.	x						
		3/4" I.D. x 8" cold trap.	x						
D. Transfer Unit (Cubicle No. 10) KS-152, KS-151	Low temperature distillation for the separation of UF_6-ClF_3 mixtures.	5" I.D. x 40" cylinders.	x						D. Transfer Unit 1. Only the two cylinders required for the transfer operation are in the cubicle at any one time. 2. Cylinders are transferred singly and maintained at least 2' from other components of the system. 3. Cylinder storage is the same as that described for Item IV-B. 4. Standard sample cylinders are properly identified.
		Vacuum pump.			x				
		5" I.D. x 12" oil surge tank.	x						
		5" I.D. x 22" alumina trap.	x						
E. Decontamination of Alumina in Acid Spray Booth KS-42	Spray cleaning of contaminated alumina placed in perforated steel trays in acid spray booth. The resultant uranium solution is processed through the recovery equipment. (See Item II.)	3' x 4' steel trays.				x			E. Decontamination of Alumina in Acid Spray Booth Analysis of the acid loop solution and the alumina is required prior to decontamination. Based on this analysis with an allowance of 10% for possible error, the operation is limited to a "safe" U-235 mass. (See Item II.)
		Uranium recovery equipment.	(See Item II.)						

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K-1301 URANIUM RECOVERY FACILITY

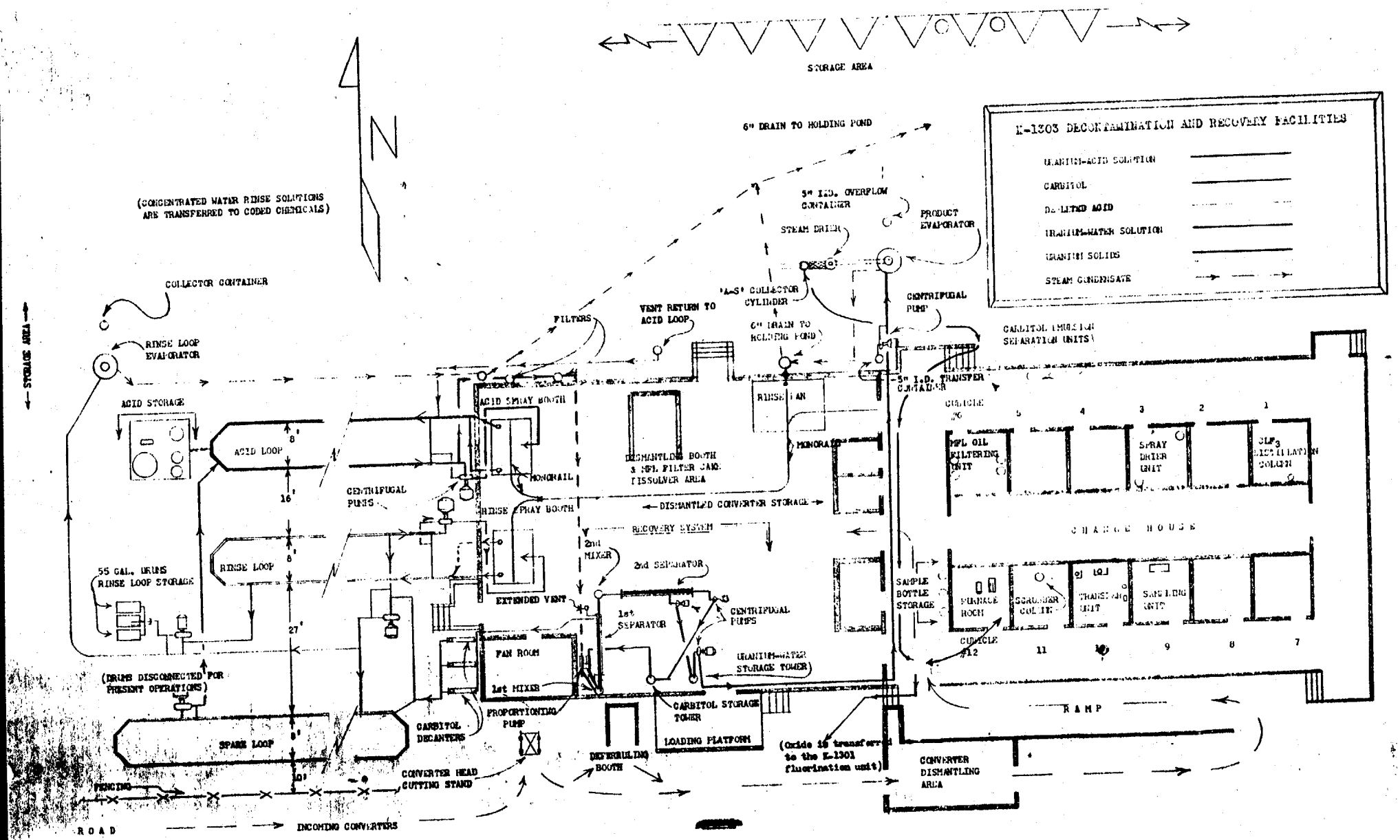
COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY						OPERATIONAL CONTROLS
			DESIGN			OPERATIONAL LIMITS			
			CYL.	SLAB	VOL.	MASS	ASSAY	CONC.	
I. Oxide Conversion Facility									I. Oxide Conversion Facility
A. Oxide Grinding and Weighing Room KS-69	Preparation of uranium oxide for fluorination or shipment. Material is ground, weighed, and transferred to furnace reactors or shipping containers.	Shipping containers.	x						A. Oxide Grinding and Weighing Room 1. Only a safe quantity of uranium oxide or a single safe container is in the room at a time. 2. No other uranium materials are stored in the room. 3. Specified transfer routes are followed.
		Grinding equipment.	x						
B. Fluorination System KS-456, KS-448, KS-141, KS-32	Conversion of uranium oxide at any U-235 assay to the hexafluoride by a fluorination process.	Fluorination reactor units:							B. Fluorination System 1. The screw reactor is charged from a single 5" I.D. x 6" container. 2. $6\frac{1}{2}$" I.D. UF_6 collector cylinders are used only for material not exceeding 2% assay. 3. Only one uranium container is in motion at one time in the fluorination room. 4. Containers are moved along prescribed routes.
		Three 6" x 36" electric furnaces each with a 5" I.D. x 36" reactor.	x						
		4" I.D. x 6' electrically-heated screw reactor.	x						
		Each fluorination reactor unit also has the following auxiliary components:							
		4" I.D. ash trap.	x						
		Dry ice-trichloroethylene bath containing two 5" I.D. x 30" or two $6\frac{1}{2}$" I.D. x 26" UF_6 collector cylinders.	x				x		
C. Exhaust System KS-456, KS-448, KS-141, KS-32	Removal of residual UF_6 from the collector cylinder vent gases.	One 4" I.D. x 30" cold trap following each reactor unit.	x						C. Exhaust System 1. Contaminated lube oil from the vacuum pump is drained to 5" I.D. containers. 2. Transfer of containers are as specified in Item I-B above.
		Common components which serve each unit:							
		4" I.D. x 5' surge trap.	x						
		27 cfm. vacuum pump with 5" I.D. oil reservoir.	x		x				

K-1301 URANIUM RECOVERY FACILITY

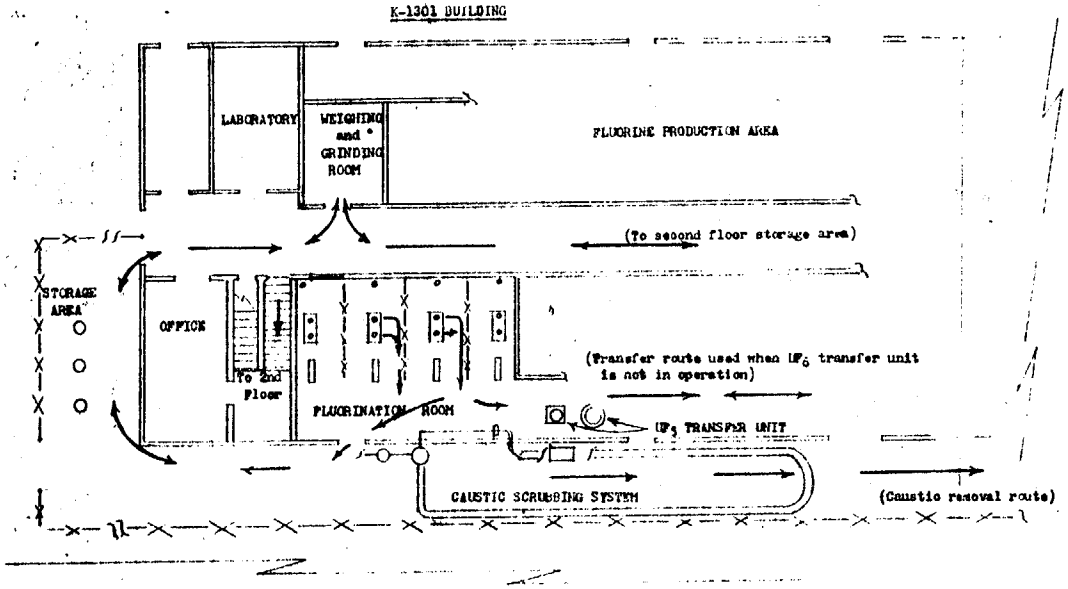
COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY						OPERATIONAL CONTROLS
			DESIGN			OPERATIONAL LIMITS			
			CYL.	SLAB	VOL.	MASS	ASSAY	CONC.	
I. Oxide Conversion Facility (Cont'd)									I. Oxide Conversion Facility (Cont'd)
D. Caustic Scrubbing System KS-235, KS-141, KS-32	Removal of residual fluorine and traces of UF_6 from the exhaust vent gases	4" I.D. x 5' dust trap.	x						D. Caustic Scrubbing System
		$6\frac{1}{2}$" O.D. x 11' caustic scrubbing tower.						x	1. The uranium concentration of the caustic solution is controlled below 1000 ppm. based on weekly uranium analyses.
		4" I.D. x 80' "U" shaped storage loop.	x						2. The caustic solution is drained to appropriate containers on a safe U-235 mass basis when the specified concentration of 1000 ppm. is exceeded.
		Centrifugal recirculating pump.		x					3. Any salt deposit in the scrubbing tower or dust trap is removed by flushing each time the loop is drained.
		2' x 2' x $4\frac{1}{2}$' caustic solution make-up tank.*							* 4. No uranium material is processed in the caustic solution make-up tank. The coupling between this tank and the loop is disconnected after each transfer operation.
II. Storage Facilities									II. Storage Facilities
A. Second Floor Storage Area KS-71	Storage of cylinders.	A barricade arrangement is provided along the south wall for the positioning of containers.							A. Second Floor Storage Area 1. Uranium containers are transferred singly. 2. Uranium containers are transferred via the east stairway only.

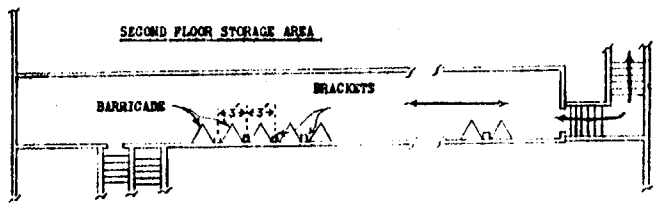
K-1301 URANIUM RECOVERY FACILITY

COMPONENT	FUNCTION	EQUIPMENT DESIGN	CONTROL METHOD SUMMARY: DESIGN CYL.	DESIGN SLAB	DESIGN VOL.	OPERATIONAL LIMITS MASS	OPERATIONAL LIMITS ASSAY	OPERATIONAL LIMITS CONC.	OPERATIONAL CONTROLS
II. Storage Facilities (Cont'd)									II. Storage Facilities (Cont'd)
B. Yard Storage Area KS-448	Storage of uranium-bearing containers.	An area enclosed with wire fencing adjacent to the west wall outside the K-1301 building.							B. Yard Storage Area 1. UF_6 cylinders are moved singly to and from the storage area along prescribed routes. 2. UF_6 cylinders are individually spaced on 5' centers.
III. Miscellaneous Operations									III. Miscellaneous Operations
A. UF_6 Transfer Unit (Located in hallway of fluorination room.) KS-141 (This operation has been discontinued and the equipment placed in standby.)	Vaporization of low assay UF_6 from small cylinders to a larger unit.	$6\frac{1}{2}$" I.D. "B" type cylinders. 12" I.D. "A" type cylinders.				x	x x		A. UF_6 Transfer Unit 1. The UF_6 transfer operation is on a safe mass basis for 2% U-235 material or below. 2. UF_6 cylinders are properly identified with tags, and weight checks are made for batch control. 3. The UF_6 transfer operation is discontinued whenever the fluorination unit is used at U-235 assays above 2%. 4. UF_6 cylinders are adequately spaced in the yard storage area or in the second floor storage facilities. (See Item II.)


STORAGE AREA
N
6" DRAIN TO HOLDING POND
(CONCENTRATED WATER RINSE SOLUTIONS ARE TRANSFERRED TO CODED CHEMICALS)
5" I.D. OVERFLOW CONTAINER
PRODUCT EVAPORATOR
STEAM DRIER
COLLECTOR CONTAINER
"A-S" COLLECTOR CYLINDER
CENTRIFUGAL PUMP
FILTERS
VENT RETURN TO ACID LOOP
6" DRAIN TO HOLDING POND
CARBITOL EMULSION SEPARATION UNITS
5" I.D. TRANSFER CONTAINER
RINSE LOOP EVAPORATOR
ACID STORAGE
ACID SPRAY BOOTH
RINSE FAN
MONORAIL
DISMANTLING BOOTH & MFL FILTER CAN DISSOLVER AREA
CUBICLE
ACID LOOP
CENTRIFUGAL PUMPS
RINSE SPRAY BOOTH
DISMANTLED CONVERTER STORAGE
RECOVERY SYSTEM
MFL OIL FILTERING UNIT
SPRAY DRIER UNIT
UF6 DISTILLATION COLUMN
CHARGE HOUSE
55 GAL. DRUMS RINSE LOOP STORAGE
RINSE LOOP
2nd MIXER
2nd SEPARATOR
EXTENDED VENT
1st SEPARATOR
CENTRIFUGAL PUMPS
SAMPLE BOTTLE STORAGE
FURNACE ROOM
CONDENSER COLLECTOR
TRANSFER UNIT
SAMPLING UNIT
FAN ROOM
1st MIXER
URANIUM-WATER STORAGE TOWER
(DRUMS DISCONNECTED FOR PRESENT OPERATIONS)
PROPORTIONING PUMP
CARBITOL STORAGE TOWER
CARBITOL DECANTERS
SPARE LOOP
DEFERRULING BOOTH
LOADING PLATFORM
(Oxide is transferred to the K-1301 fluorination unit)
RAMP
CONVERTER DISMANTLING AREA
FENCING
CONVERTER HEAD CUTTING STAND
ROAD
INCOMING CONVERTERS
K-1303 DECONTAMINATION AND RECOVERY FACILITIES
URANIUM-ACID SOLUTION
CARBITOL
DILUTED ACID
URANIUM-WATER SOLUTION
URANIUM SOLIDS
STEAM CONDENSATE
— FEED MATERIALS —

K-1301 URANIUM RECOVERY FACILITY





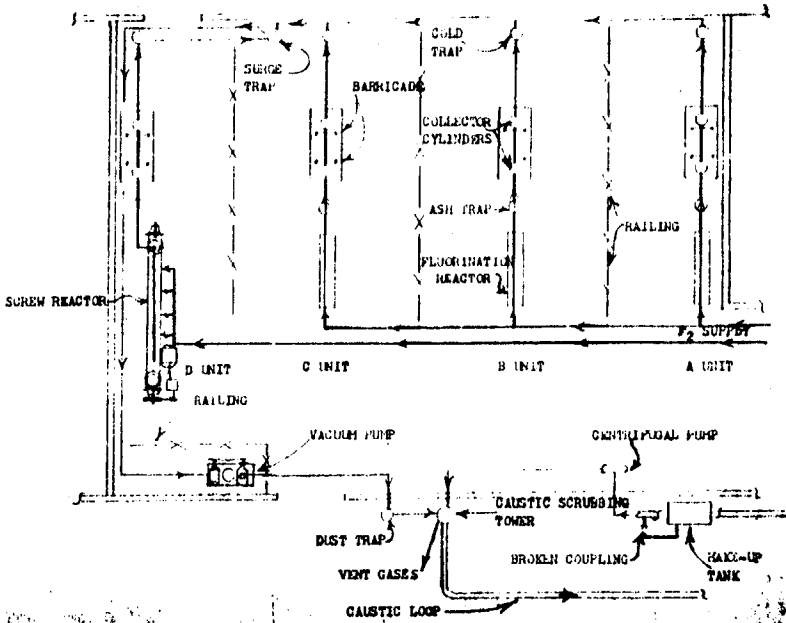
TRANSFER ROUTE ——————

FLUORINE SUPPLY ——————

UF_6-F_2 GAS MIXTURE ——————

F_2 & RESIDUAL UF_6 VENT GASES ——————

FLUORINATION ROOM DETAIL



ChemRisk/Shonka Research Associates, Inc., Document Request Form

2594

(This section to be completed by subcontractor requesting document)

J. Lamb / 1034A

Requestor / Document Center (is requested to provide the following document)

Date of request 2/16/96 Expected receipt of document 3/16/96

Document number KS-20 Date of document 12/31/48

Title and author (if document is unnumbered)

(This section to be completed by Document Center)

Date request received 2/22/96

Date submitted to ADC 2/26/96

Date submitted to HSA Coordinator 2/22/96

(This section to be completed by HSA Coordinator)

Date submitted to CICO 2/26/96

Date received from CICO 3/6/96

Date submitted to ChemRisk/Shonka and DOE 3/6/96

(This section to be completed by ChemRisk/Shonka Research Associates, Inc.)

Date document received

Signature

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KS 20 5 A

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This document consists of 21 pages,
No. 5 of 13 copies, Series A.

INTER-COMPANY CORRESPONDENCE

(Insert Name) COMPANY Carbide and Carbon Chemicals Corp. LOCATION Post Office Box P Oak Ridge, Tenn.

TO Mr. J. P. Murray
LOCATION K-303-7

DATE December 31, 1948

APPROVAL LETTER NO. 49

SUBJECT Change in Decontamination Facilities - K-1303

COPY TO Mr. R. M. Batch
Dr. C. K. Beck
Mr. C. E. Center
Mr. S. Cromer
Mr. A. P. Dunlap
Mr. A. P. Huber
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This document has been approved for release to the public by:
Technical Information Officer
Oak Ridge K-25 Site
6 Aug 96
Date

KS-20

Classification changed to Unclassified (Level and Category)
K-25 Classification Office
(AEC) Authority of J D McHaugh 7/31/95 Date
By E R McCaskill 2/20/96 (Signature of Person Making Change) Date
Verified by Roland P. Prince 2/20/96 (Signature of Person Verifying Change) Date

PLANT RECORDS DEPT.
CENTRAL FILES
REC. 11584
FILE 464 B-4
X-REF. 7755
X-REF. KS-20

Introduction

To improve operation of the K-1303 decontamination facility it has been necessary to consider several changes in equipment and procedure. This facility is used primarily to decontaminate converters removed from the cascade, by means of spray chambers.[1] Essentially the changes include (1) additional drains; (2) pump alterations; (3) new storage loop; (4) interconnecting piping for solution transfer or sampling, and others. In conjunction with the installation of a new storage loop special hazard considerations were made of the design and possible location of such new facilities as a vertical evaporator, centrifuges, and new feed, drain and condensate lines. (Figure 1).

The changes and special hazard considerations are discussed for each unit under the headings of (1) Modifications of Existing Facilities and (2) Proposed Facilities. A summary of total interaction effects on the most critical points is given at the end of the letter.

1. Approval Letter No. 36 - May 28, 1948 - Converter Decontamination Facilities in K-1303.

Classification changed to UNCLASSIFIED
ADC or ADO signature (first reviewer) Date
Authorized Derivative Classifier (final reviewer) 7/31/95 Date

Carbide and Carbon Chemicals Corporation Operating Contractor for the U.S. Atomic Energy Commission.

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Modifications of Existing Facilities

I. Spray Chamber

A. Drains (Figure 1)

The addition of several nozzles to the spray banks in the acid and water rinse spray chambers provided sufficient inlet capacity to increase the solution level above the allowable 1.5 inch limit for decontamination purposes. Relief overflow provided by the $\frac{1}{2}$ x 8 inch overflow slot in the side of the chambers created a contamination problem which was eliminated by the addition of a $\frac{1}{2}$ x 8 x 10 inch collector pan and a 1 inch drain line connecting to an overflow vent line on the loop. With a limit solution level of 1.5 inches in the chamber, the probability increased that even partial plugging of the 5 inch drain would cause the limit to be exceeded before the overflow would be noted and the pump shut down.

To provide more adequate drainage a 4 inch drain was installed on the west side of each spray chamber, 6 feet from the 5 inch drain. The new drain was reduced to 2 inches at a distance of one foot below the floor and connected into the 2 inch by-pass line on the discharge side of the pump. There are no valves in these lines.

The interaction effect of the 2 inch line on the pumps need not be considered since the 2 inch lines are concealed from the pumps by pipes previously calculated. The 4 inch section increased the solid angle at the center of the spray chamber an allowable 0.012 radians. With the loops recycling through the by-pass connections, the solution backed-up through the 2 inch drain to a depth of $\frac{1}{2}$ to 1 inch on the floor of the chamber. This operational difficulty was later eliminated by the installation of a new line as noted in section (A) under Loop Pumps.

B. Level Controller (Figure 2)

Leakage of solution past the spray chamber doors was remedied by raising the edge of the chambers at the door to a height of 3 inches. In effect, this reduced the overflow capacity required when the 1.5 inch level was exceeded. Test runs at full operating conditions indicated that the 1.5 inch allowable level was exceeded when either drain was blocked.

Interaction limitations prevented the installation of additional drains and the enlarging of the existing drains. A system of electrical control was devised whereby the pumps would automatically be shut down upon a shorting of the circuit by the solution when it reached a height of 1.5 inches at the rear of the chamber, the deepest point. Since the spray action and surging of solution is greater at the rear of the chamber the unit is installed at the west wall near the front of each booth, at which point the elevation of the chamber floor is

½ inch higher than at the rear of the chamber. The small quantity of solution added to the chamber as the pumps shut down is negligible.

The unit consists of a probe contact in the vertical section of a 2 inch diameter 'T' installed in the side of the chamber, with a relay mounted directly above. A plastic sight glass is installed at one end for observing the liquid level. A weir with a series of ½ inch openings eliminates surges in the tube. The contact is set for a solution height of 1 inch, with the top lock nut drilled and sealed. The electrical wiring is inclosed in rigid conduit, with the relay and probe section inclosed in a locked box which is under the jurisdiction of the supervisor. Operating tests are made weekly of the relay operation. With the added drainage facility and positive relay action to stop the pumps, the overflow slot may be eliminated.

On the basis that a 5 inch pipe may not connect into a slab thicker than one inch, it was specified that the solution level be reduced to one inch in the vicinity of the drains, within a radius of 7.5 inches of the center of each drain. This was accomplished by installing a heavy steel plate, one inch thick, hinged to the west wall one inch above floor level.

II. Loop Centrifugal Pumps

A. Relief Valve and Line (Figure 1)

To provide relief from excessive pump pressure when the Y strainers on the discharge side of the pumps became clogged and also to provide for re-cycling in a manner which would not allow backflow through the two inch spray chamber drain line, a 1.5 inch line with a relief valve was connected from each pump to the existing 2 inch cross-over line on the suction side. This 1.5 inch line extends west in the plane of the pump a distance of 4 feet, then south for 2 feet and tees into the cross-over line between two valves. The valve on the drain side of the cross-over line is open to permit re-cycling of material as the relief valve opens.

To compensate for the increased interaction effect on the pump it was necessary to remove half of the by-pass line. This exposed the newly installed 2 inch drain line which added an allowable .006 steradians at the pumps. Furthermore, to allow for an additional ½ inch feed line from the pump discharge to the carbitol tower, it was necessary to relocate the existing one inch carbitol feed line in such a manner that it is more removed from the circulating pump.

B. Drains (Figure 1)

Maintenance of the Y strainer on the discharge lines of each pump or on the pump itself required draining solution from the isolated lines. For this purpose a ½ inch pipe drainage system was provided. The ½ inch drain line connects to the Y strainer and a ½ inch opening drilled in the base of the pump housing, and extends westward in the

plane of the pump housing a distance of 15 feet. These drain lines from the two storage loops join and run near the ground 8 feet north beyond the loops to an "always-safe" 4 inch bucket within a 5 inch casing sunk in the ground. Drainage is controlled by valves in the line at each pump and Y strainer and near the bucket.

The interaction on the pump due to the $\frac{1}{2}$ inch drain and collector can was an allowable 0.004 radians. The solution from the 4 inch collector bucket may be poured into an empty 5 inch bucket spaced 6 feet from the container in the ground.

C. Water Seals (Figure 3)

Water seals supplied by a 55 gallon reservoir on the K-1303 roof were installed on the loop circulating pumps to prevent loss of uranium solution. In this manner, water would leak through the packing into the pump instead of solution leaking out onto the ground. However, frequent packing gland failures caused excessive dilution of the acid solution. Furthermore, when the pump discharge pressure built up if the discharge valve was closed, it was found that uranium solution was forced through the seal into the low pressure water supply. Under these circumstances, the water reservoir must be of "always-safe" dimensions. Therefore, this system was disconnected at the pumps and other methods for prolonging the packing life investigated. Changes in packing type, pump speed (1750 to 1100 rpm) and installation of a pressure relief by-pass have proved successful.

Consideration was given to the design of an "always-safe" water supply system for possible future use on pump seals. A 6 foot tank of 4 inch pipe may be located approximately 20 feet in from the west edge of the roof. A 21 foot, 3/4 inch feed line from the tank may divide into two $\frac{1}{2}$ inch sections just below roof level. Each line may extend downward 10 feet and then along the 2 inch pump discharge line to the seal. These lines should be in a plane passing through the pump housing perpendicular to the shaft and their interaction on the pump need not be considered. The liquid level in the tank can be maintained within a 1 foot range by a float control which will operate a mercoid switch to open or close a solenoid valve on the inlet water supply. An immersed heating element can be controlled to function slightly above freezing temperature. Insulation to a depth of $\frac{1}{2}$ inch may be applied.

D. Evaporator Supply Pump (Figure 1)

The Milton-Roy proportioning pump which supplied the water rinse solution to the evaporator as well as make up water to the loop was replaced with an "always-safe" centrifugal pump 1 inch by 6 inches in diameter. The flow to the evaporator is measured by a rotometer and controlled by throttling a valve in the line. Make up water to the

rinse loop is now supplied at the water rinse spray chamber by hosing down the equipment with sanitary water after the normal rinse period.

III. Stainless Steel Floor and Drain (Figure 1)

To control contamination and to minimize the loss of uranium solutions dripping from decontaminated equipment in transfer from the acid spray chamber to the water rinse chamber, a stainless steel floor was installed with a drain to the acid loop. This flooring covers the general area of the spray chambers and dismantling booths and extends to the north wall. The flooring slopes 1/32 inch per foot to a 4 inch drain in the northeast corner. A removable mesh grating covers the floor with a slight clearance for solution drainage.

Ten inches below floor level the 4 inch drain reduces to 2 inches and connects to a 2 inch drain extending north 8 feet from the building, then west and south to tie into the 4 inch acid loop drain line. Approximately 30 feet of 1 inch acid return line from the carbitol tower to the loop was eliminated by tieing directly to the 2 inch drain at a point 6 feet from the building. The 2 inch drain line is extended eastward three feet and vertically 2 feet with a 3 inch funnel for the return of contaminated solutions to the acid loop. The open end corresponds in elevation to a solution height of 1.5 inches in the acid spray chamber.

The stainless steel floor is considered to be in the horizontal plane of the spray chambers and therefore the interaction need not be considered. The interaction on the center of the acid spray chamber due to the entire length of 2 inch drain line was 0.040 radians.

IV. pH Controller - Acid Loop (Figure 4)

To control automatically the degree of acidity in the acid loop, a pH controller and recording equipment was installed approximately 28 feet west of the water rinse loop.

Essentially the equipment consists of a Milton-Roy Proportioning Pump supplying a fixed ratio of 1 part acid solution from the loop and 9 parts of water to a Leeds and Northrup pH electrode chamber. This mixture is then returned to the water rinse loop. Electrical impulses actuate a Leeds and Northrup pneumatic recording controller which in turn operates an air controlled valve on the acid loop, automatically permitting measured amounts of nitric

acid from the storage tanks to enter the loop. A portion of the solution from the acid loop supplying the pump is diverted to a specific gravity meter of 1 inch stainless steel pipe, 15 inches long. The remaining acid solution by-passes the above equipment and together with the discharge from the specific gravity meter is then returned to the acid loop by means of the acid supply line from the 55 gallon acid storage drums. The acid supply line to the pump is $\frac{1}{2}$ inch in diameter, the return lines to the loops are of 1 inch diameter.

The 55 gallon acid drums connect to a common header to supply make up acid solution to the acid loop. The return line from the pH equipment connects to the loop and to this acid supply line. Since the return solution will be pumped from the pH equipment to the loop, an overflow vent unit is installed in the return line to avoid the possibility of uranium solution entering the drums in case of mis-valving. The vent opening is below the base of the drums. The bottom of each drum is 30 inches above the storage loop at the tie in point and 20 inches above the spray chamber level.

When the pH equipment is not in use, the pH acid return line can be used for supplying acid solution from the drums to the loop if the valve in this line is open to the vent section to prevent surges from the loop entering the acid drums. A check valve will be placed in the unused acid supply line before the pH system is placed in operation.

The pH equipment size and location is safe. The interaction effect on the 4 inch section of the acid loop of the $\frac{1}{2}$ and 1 inch pH lines is 0.020 steradians.

V. New Storage Loop (Figure 1)

A closed loop of 5 inch stainless steel tubing is installed to provide for the storage of solutions from the acid or water rinse loops. These solutions may either be excessively concentrated or diluted, and may contain large quantities of soluble iron compounds and carbitol solution. A considerable improvement in operating efficiency is anticipated by the temporary storing of these contaminated solutions and the utilization of new solutions in the loops.

The loop is 39 feet south of the south wall of the water rinse loop approximately 30 feet from the edge of the K-1303 building. The parallel, 5 inch diameter sections of the loop are 8 feet apart. The ends of the loop are reduced to 4 inch diameter pipe, 4 feet from each bend. The loop slopes from an elevation of 783.64

at the east end to a low point of 781.8 on the northwest side, 28 feet from the west end of the loop. From this low point, a 1 inch pipe connects to the suction of the pump supplying the evaporator. A 1 inch diameter vent, 2 feet high, limits the solution height in the loop to the liquid height in the spray chambers.

Interconnecting 1 inch lines drain the low side of the acid and rinse loops to a 3/4 inch Worthington Centrifugal Pump, 8 feet south of the rinse loop. The pump discharges through a 1 inch line to the new loop. A 3/4 inch Y strainer is on the suction side of the pump; both strainer and pump may be by-passed. The 1 inch drain lines, 15 inches apart, tee into the bottom of the 5 inch sections of the acid and rinse loops and drop 6 inches before sloping to the transfer pump. They connect midway between the lines of the rinse loop to form a common header to the transfer pump. The new loop may be by-passed and solution sent directly from the transfer pump to the evaporators through a 1 inch line connected to the pump discharge. To minimize the interaction on the loop pumps, the transfer lines were spaced a distance of 33 feet from the pumps. The interaction on the water rinse pump by these lines, the new loop and the loop 1 inch by-pass line is 0.008 steradians.

VI. Insulation (Figure 7)

The storage loops in the K-1303 Area are of 5 inch, welded stainless steel tubing, steam traced. To provide against heat loss and at the same time protect against the insulation absorbing uranium solution in event of pipe leakage, an "always-safe" insulation shield was designed. This consists of #26 gage stainless steel bent into a circular liner, $5\frac{1}{4}$ inches I.D. with a 5/8 inch gap on one side. A spacer button of 1/8 inch projection is indented at space intervals on the side opposite the opening. When installed, this spacer button permits drainage of leakage to the bottom opening.

The cover is placed on the pipe with the spacer button at the top and the open section extending beneath the steam pipe. Spacer bolts through backing strips at the opening are used to hold the cover in position while maintaining a 5/8 inch gap for drainage. Insulation may then be applied over the liner.

Proposed Facilities

Special hazard studies were made of the design and location of additional processing equipment such as (1) a vertical evaporator with collector and condenser units; (2) centrifuges, and (3) necessary

feed, drain and condensate lines. The study included the operation of the present equipment in conjunction with the new facilities, the alterations required, and various combinations of equipment and operations.

I. Vertical Evaporator (Figures 5 and 6)

A vertical steam heated evaporator of 50 gph capacity will be installed 22 feet west of the 48 inch circular evaporator at the west end of the acid loop. It will consist of 8.75 feet of 5 inch stainless steel tubing enclosing 19, 3/4 inch stainless steel tubes 6.25 feet long, through which the solution will flow. The solution vapors will be vented at the top through two separators and a condenser, in series. The evaporator base will be reduced to form a 4 inch diameter 10 inch long section, with 1 inch feed and product return lines. A parallel 1 inch line, 2 feet from the evaporator, serves as a recycle and overflow line. It will connect to the tower at three points; at the base, at the collector section above the steam chest for recycling of the unconcentrated solution, and at the top for venting. The overflow will be returned to the loop from a point 6 inches above the recycle section. A sight gage will be connected close to the east side of the recycle line; thus only the interaction of the recycle line on the tower need be considered. The product withdrawal line will connect with the centrifuge header.

Insulation to a depth of $\frac{1}{2}$ inch may be placed on the vertical evaporator. The possibility of the uranium solution leaking through the tubing and then through the 4 and 5 inch casings in order to reach the insulation is extremely remote since both components will be pressure tested. In addition, the cross-sectional area available is less than that corresponding to a 5 inch pipe due to the wall thickness of the enclosed 19 tubes.

A preliminary separator is mounted on top of the vertical evaporator. This is a 2 foot diameter, 3 foot high, baffled section in which any entrained material or condensed vapor is collected and returned to the evaporator. The gases then flow through a 9 inch vent to a second separator, three feet away. The base of the preliminary separator slopes to form a collector pan with a drain for returning solution to the 1 inch recycle line. An overflow is provided so that at no time could the liquid in the pan exceed a depth of 1.5 inches. The separator will be covered with 1.5 inches of water proofed insulation.

The second or final separator is 4 feet in diameter and 4.8 feet high. The inlet pipe enters at the side and extends downward 2 feet. The gases flow past a baffle to the top of the separator

where, by means of a two-way valve, they may be vented to the air or to an air-cooled condenser. Stainless steel coils are provided within the separator for steam heating to prevent condensation. The base slopes to a 3 inch outlet pipe connecting to a water seal and overflow. Any liquid collected is returned to the recycle line of the evaporator. A door will be installed on the separator for inspection or cleaning purposes.

The condenser unit will be considered when the design work is completed.

The hazard considered was the accumulation of uranium solution in the separators by condensation, or from cleaning operations. The installation of an overflow and drain was considered adequate protection since the liquid level in either separator is thus limited to 1.5 inches. In addition, a $\frac{1}{2}$ inch vent is installed on the evaporator overflow line, the opening of which is at a lower elevation than the separators.

The total interaction on the vertical evaporator is 0.355 steradians.

II. Centrifuges (Figure 6)

Two high speed centrifuges of the type considered safe for the recovery system[1] will be installed in parallel in the product return line from the evaporators to the acid loop. The primary purpose will be to remove any precipitated iron compounds and other solid material from the solution, with the filtrate returning to the loop. Each centrifuge may be by-passed. An Easton centrifugal pump, 1 inch by 6 inch diameter will supply the solution to the centrifuges.

The centrifuges will be air powered with maximum speed of 50,000 rpm. Each rotor is 1 3/4 inches in diameter, and 11 inches in height. The centrifuge housing is of conical construction 12 inches high with a maximum diameter of $5\frac{1}{2}$ inches at the top.

1. Approval Letter No. 42 - Approval of Uranium Recovery in K-1303 September 24, 1948.

Two ½ inch drain openings in the housing will prevent accumulation of solution.

The centrifuges are spaced 6 feet apart to allow the use of "always-safe" buckets in the event that they are required to collect filtrate. They are 11 feet and 17 feet respectively from the circular evaporator, to which they contribute 0.0017 steradians. Only the shallow collector pans are used, with total volume less than 108 cubic inches.

III. Interconnecting Piping (Figures 1 and 6)

Parallel one inch feed and drain lines may be mounted in a group, 6 inches apart, 17 feet west of the loop and connected through a manifold arrangement directly to the evaporators and loops. By means of this piping manifold, it will be possible to feed the contents of any loop to each evaporator either directly or by the use of crossovers at a rate measured by rotometers in the two main supply lines. Conversely, it will be possible for the overflow from each evaporator to be drained to any loop. The equipment will be steam heated with the condensate collected by various headers and drained to the present 4 inch condensate drain line.

Solution is supplied from the west end of the loops to the evaporator supply pump, or directly to the evaporator by means of the transfer line and pump at the east end of the loops. The new loop will connect to the suction side of the evaporator supply pump for direct flow to the circular evaporator. The evaporating capacity of the circular and vertical evaporators is 15 and 50 gph, respectively.

The feed and drain connections at the manifold and to the evaporators will be held as closely as possible in the plane of the circular evaporator to reduce the interaction effect. The manifold is 9 feet from the circular evaporator and 21 feet from the vertical evaporator. The present feed line to the circular evaporator will be removed and a new inlet made on the west side. A new overflow drain will be installed on the south side of the evaporator.

The lines will be steam traced. The parallel feed and drain lines south of the manifold may be inclosed in a rectangular box, insulated at the top and sides, with irregularly spaced ½ inch holes in the bottom to provide drainage in event of a leak.

Summary and Conclusions

1. The above equipment to be used in the decontamination process, with the possible exception of the spray chambers, has been so designed that significant quantities of uranium in solid or solution form can only exist in "always-safe" geometries. The two floor drains in each spray chamber are adequate to prevent the solution level from exceeding a safe height, provided they do not become plugged. In the latter event, reliance must be placed on the operator and the automatic level controller to maintain "always-safe" conditions.

2. The interaction of the various components of the system on each other is safe. The solid angle at various points is as follows:

	Calculated Steradians	Allowable Steradians
Spray Chamber	0.371	0.38
North Carbitol Decanting Tower	0.342	0.38
Acid Loop Circulating Pump	0.385	0.38
Water Loop Circulating Pump	0.370	0.38
Center of 4 inch section west end of Acid Loop	0.340	0.38
Circular Evaporator Acid Loop	0.330	0.38
Vertical Evaporator	0.355	0.38

3. The liquid level controllers on both spray chambers which cut off the pump when a liquid height of 1.0 inches where the contacts are located is reached, should be checked at least once a week for proper operation. The corresponding maximum solution level is 1.5 inches.

4. In the event that the pH control system is placed in operation and the contents of a 55 gallon drum are fed to the acid storage loop through the acid supply line, it is necessary that appropriate safeguards be taken to prevent material from the loop entering the 55 gallon drum in the event of a surge. This can be accomplished preferably by installing a vent line or a check valve in this acid supply line. For added protection, the valves on the individual feed lines to the drums should be closed as soon as the drum is empty.

[redacted]

5. Additional consideration must be given to the handling of uranium material outside the system. It is not feasible at this time to specify a permanent arrangement for collecting, transporting, and storing material since these matters are still subject to considerable changes in operation. However, as each case arises, consideration must be given to the interaction effects and temporary specifications made. Such a temporary arrangement now in effect is attached.

6. To prevent accumulation of uranium solution in the K-1303 basement chamber in the event of a leak in the spray chamber bottom, or other equipment in this building, it is necessary that a frequent inspection schedule be followed in checking the basement for evidence of such leaks and prompt corrective action taken. This is in addition to periodic checks of the concrete floor underneath the stainless steel chamber. Consideration should be given to installing a sump pump in the basement for automatically removing any liquids.

SV:AJM:lja

A. J. Mallett

APPROVAL COMMITTEE ON RADIATION HAZARDS

C. K. Beck

S. Cromer

S. Visner

[redacted]

Collecting, Handling and Storage of Uranium Material - K-1303

"Always-Safe" Buckets

Temporary Locations:

1. a. One underneath one end of cubicle table for collection of residue from centrifuge collectors.
   b. One at opposite end - 2 feet from table, to collect wash water when table is cleaned.

   Note 1 - This table to be either in cubicle 8 or 9 or along the railing in front of these cubicles.

2. a. At railing near filtrate cubicle (#10) to collect wastes from clean up of spills.

3. a. At railing near centrifuge cubicle (#11) to collect wastes from clean up of spills.

   Note 1 - These cylinders should not be moved inside cubicles for clean up of material. Material should be cleaned up with trays and sponges and emptied into buckets.

   Note 2 - A spacing of 6 feet between buckets is adequate.

4. One "always-safe" bucket may be kept no closer than 6 feet from edge of evaporator at end of acid loop.

5. Buckets needed for experimental carbitol extraction are to be stored near the fence west of the present storage cages and spaced 6 feet apart.

6. One bucket may be placed under each of the following:

   a. The settler tank, and, if necessary, removed to storage when filled.
   b. The experimental carbitol tower, approximately 2 feet below, and removed as necessary.

   Note - The above buckets should be removed approximately 3 feet horizontally before lifting for carrying.

7. Storage of buckets should be at apex of V arrangement near fence on north side of building and chained to the posts. No cylinders should be placed at open ends of the V. Only one bucket should be in transit at one time and only when authorized by the foreman-in-charge.

55 Gallon Drums

1. Solutions from loops or other containers can be placed in 55 gallon drums only when analysis is less than 1.75 gr./liter or 1750 ppm. This figure is based on the highest plant assay. It is assumed that proper sampling techniques will be employed to insure representative samples.

2. Drums should be spaced 16 feet, center to center.

3. Drums should not be brought closer than 20 feet to the loops when draining is required.

4. When the concentration is less than 1.75 gr./liter solutions from the two liter (5") bottles may be poured into the drums.

Two Liter Bottles

1. Only one near proportioneer pump at carbitol tower.

2. Only one for carbitol collection at the decanting towers.

3. Only two near evaporator at end of acid loop for collection of solution. These should be spaced 2 feet apart.

4. Two liter bottles stored in field should be spaced in rectangular pattern at minimum spacing of 4 feet, center to center. They should not be placed near the drums and any grouping should be at least 20 feet from the loops or evaporator.

5. Other containers or bottles should not be stored among, or carried over, the stored bottles.

6. Two - 2 liter bottles may be carried at one time, one in each hand.

7. If necessary to cross the loops, only one - 5" bottle should be carried at a time and held at least 18 inches from the loop.

Sampling Bottles

Where the analysis is not known there should be no more than 3 small laboratory sampling bottles together at one time and these groups should be a minimum of 18 inches apart.

12-15-48
AJM:lja

[redacted]

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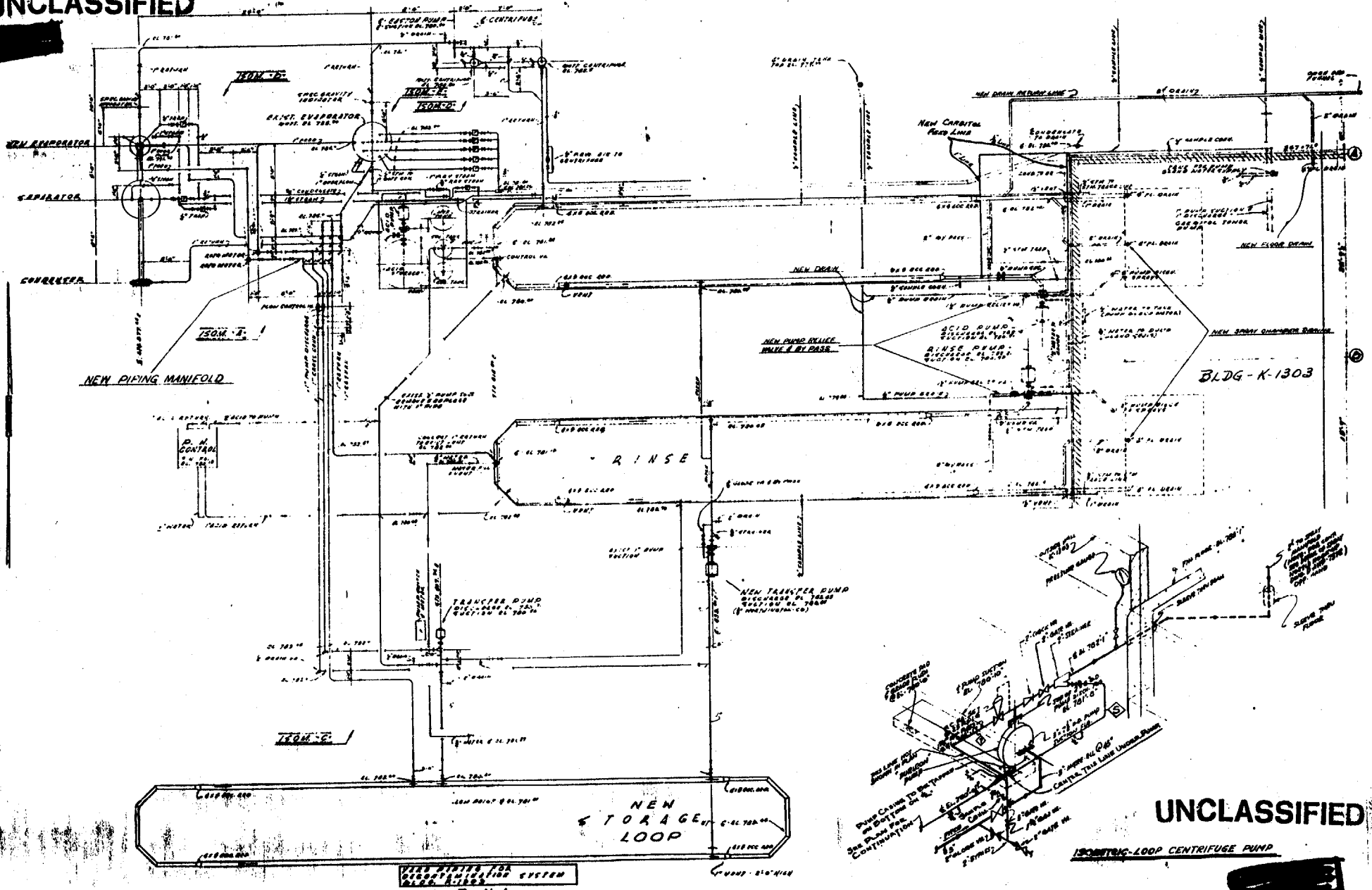

Fig. No.1

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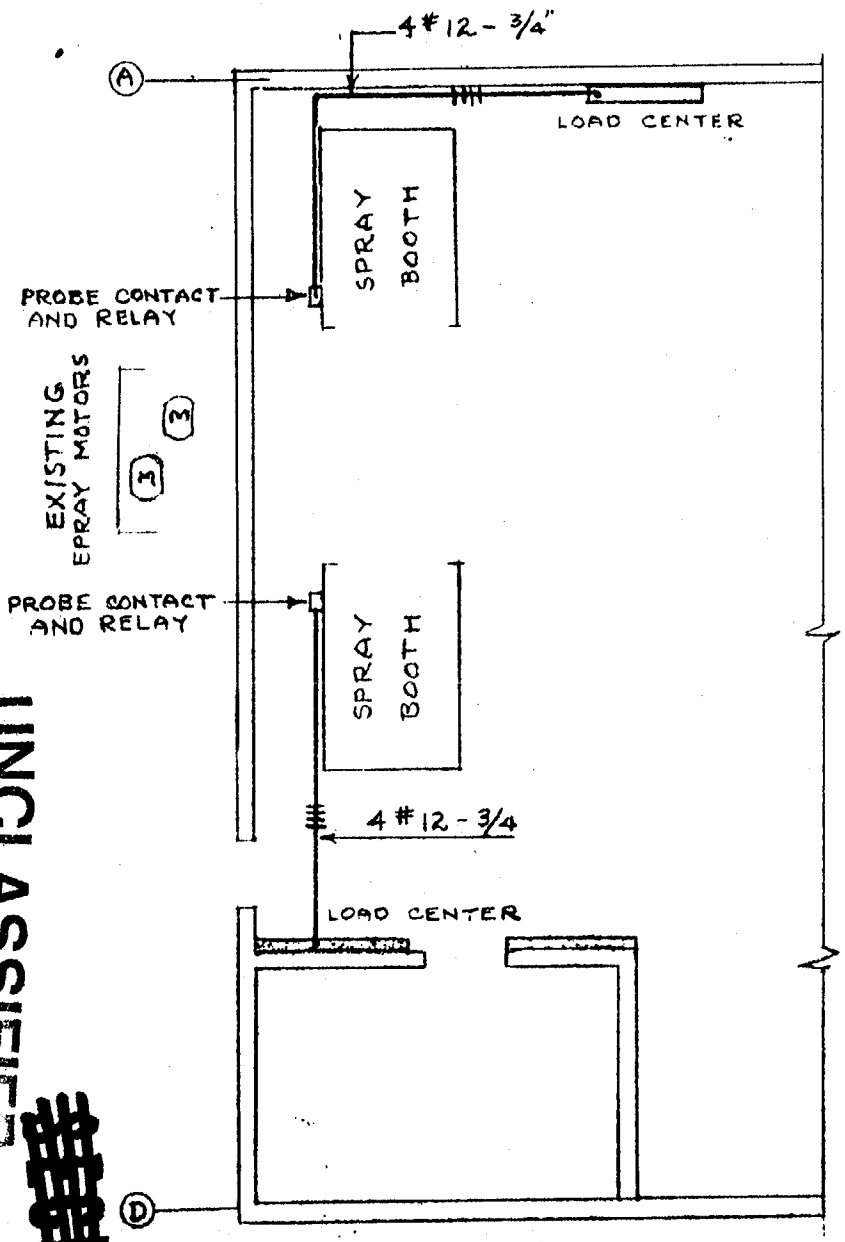
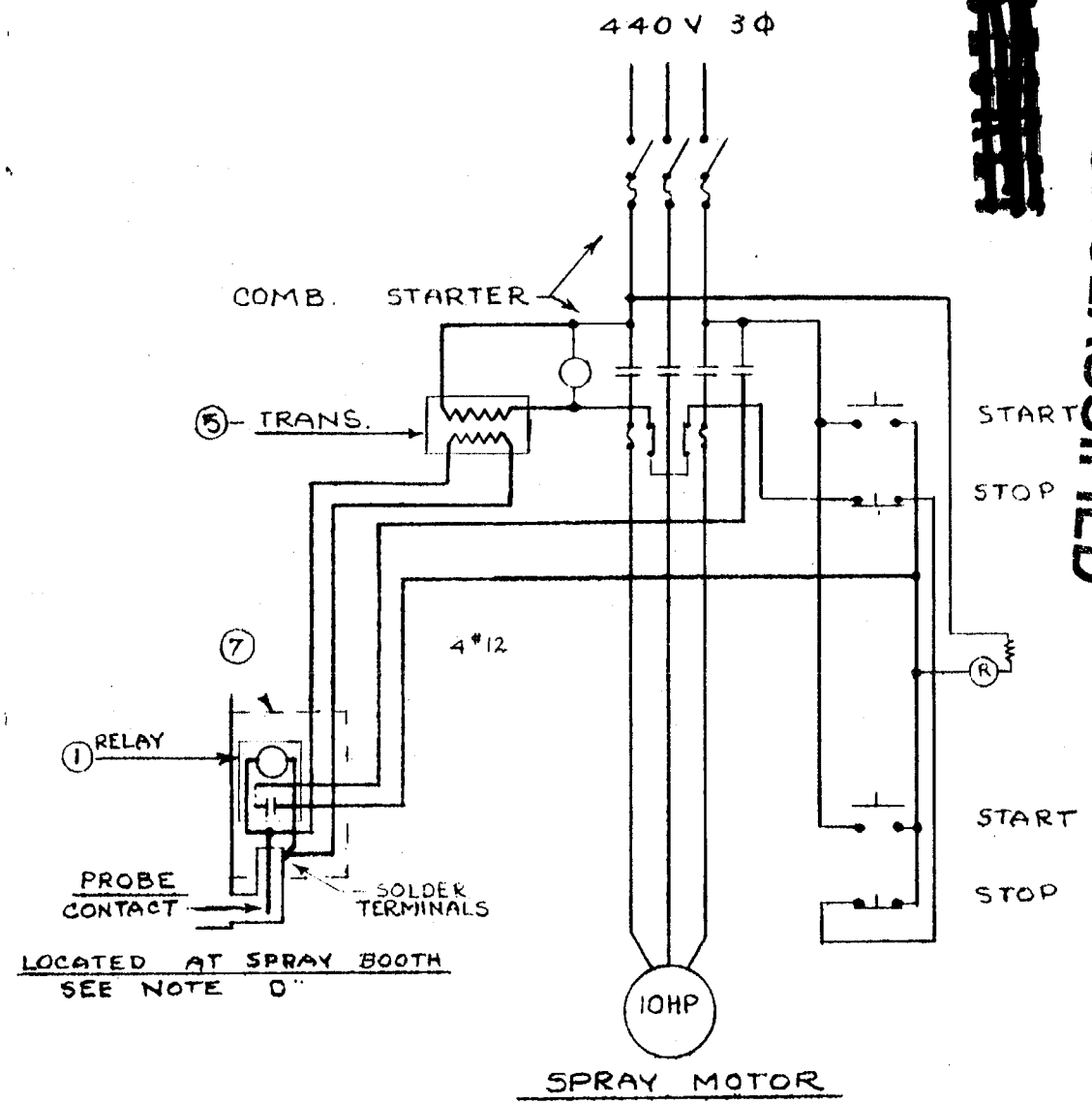


PLAN BLDG K-1301

SCALE: 1/8" = 1'-0"

Fig. No 2



WIRING DIAGRAM

TYPICAL FOR BOTH SPRAY MOTORS

K-1303
SPRAY PUMP CONTROL

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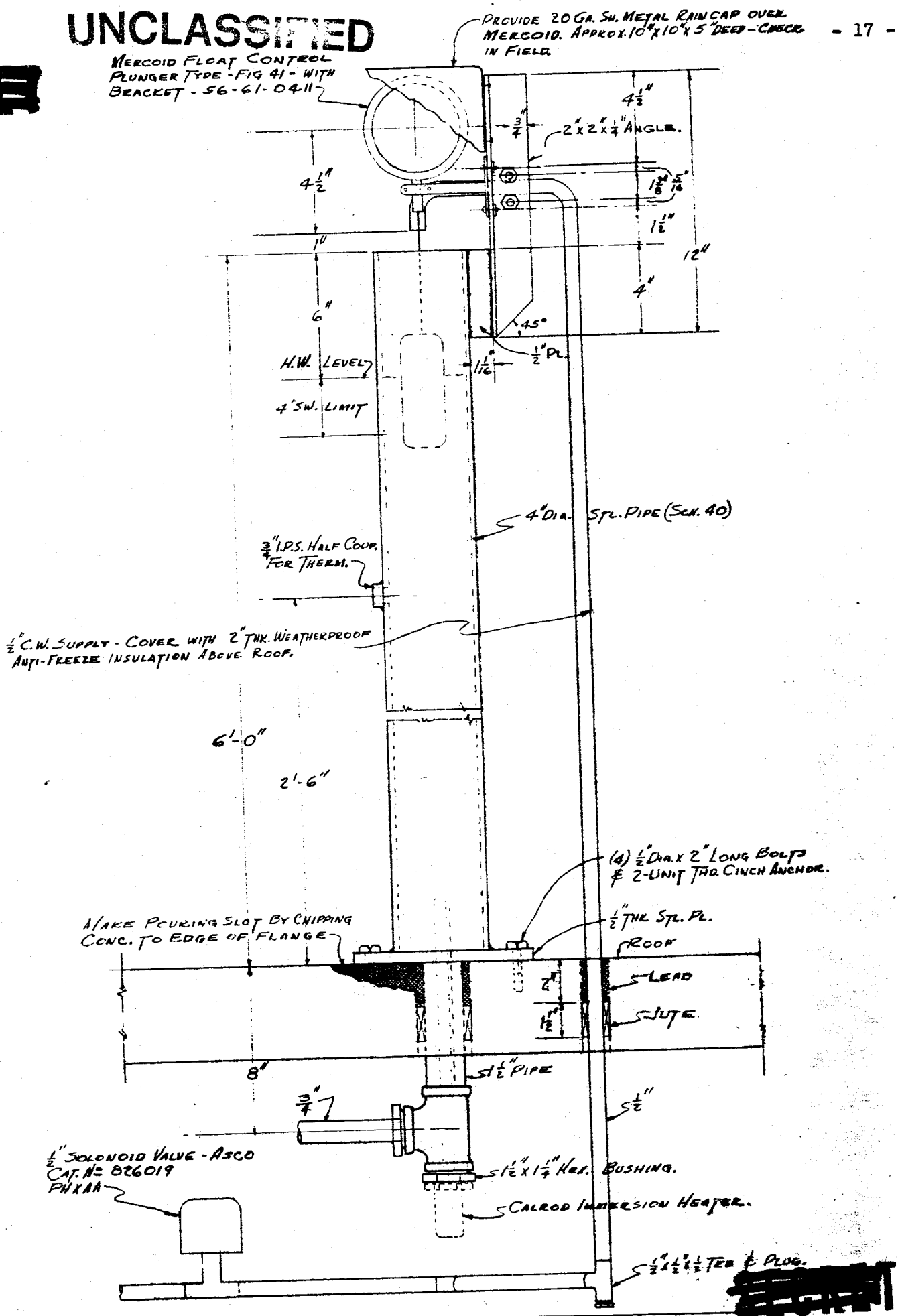

FIG. No. 3

BLDG K-1303 - DECONTAMINATION PUMP GLAND WATER TANK & VALVE

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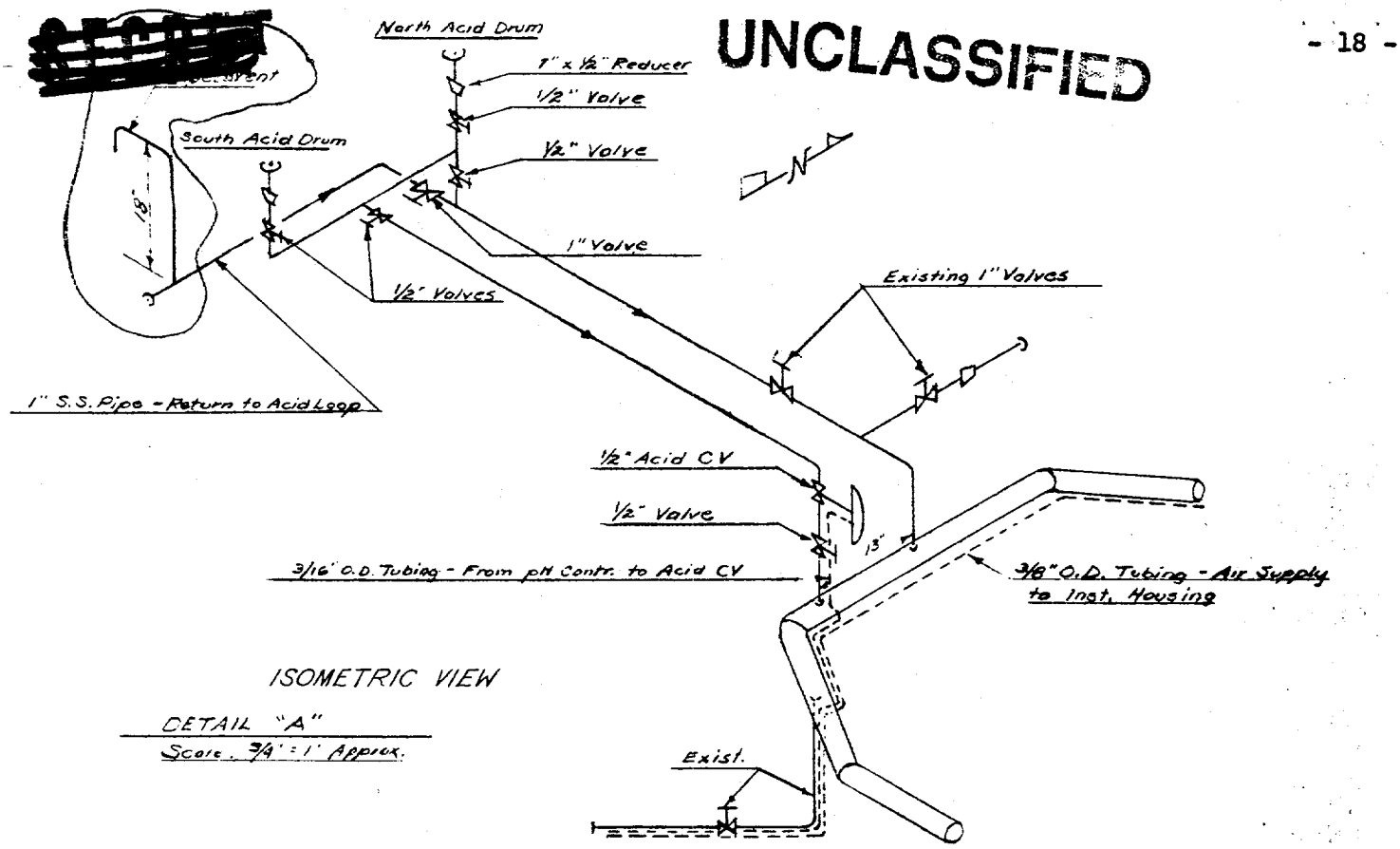
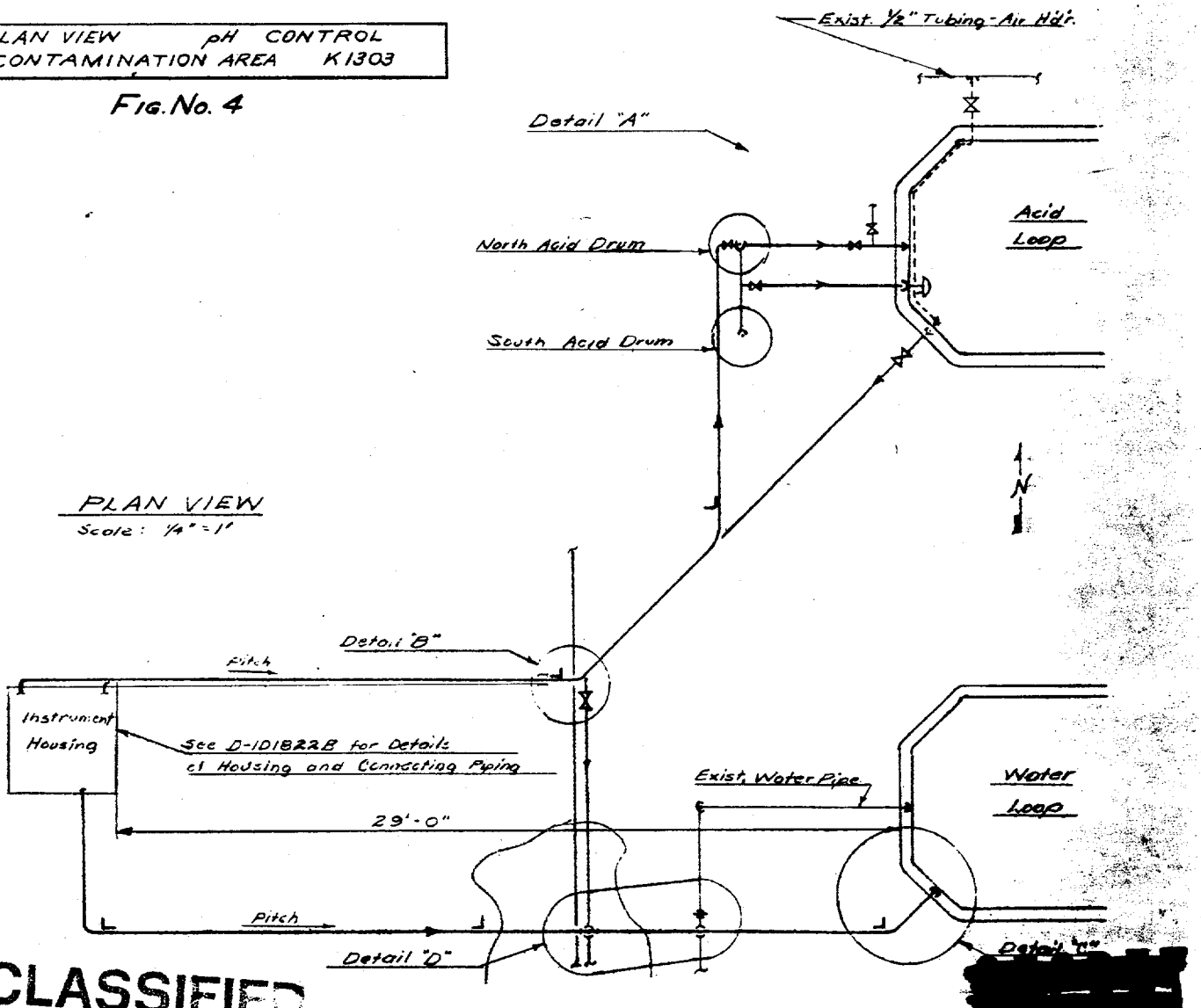


PLAN VIEW pH CONTROL
DECONTAMINATION AREA K1303

FIG. No. 4



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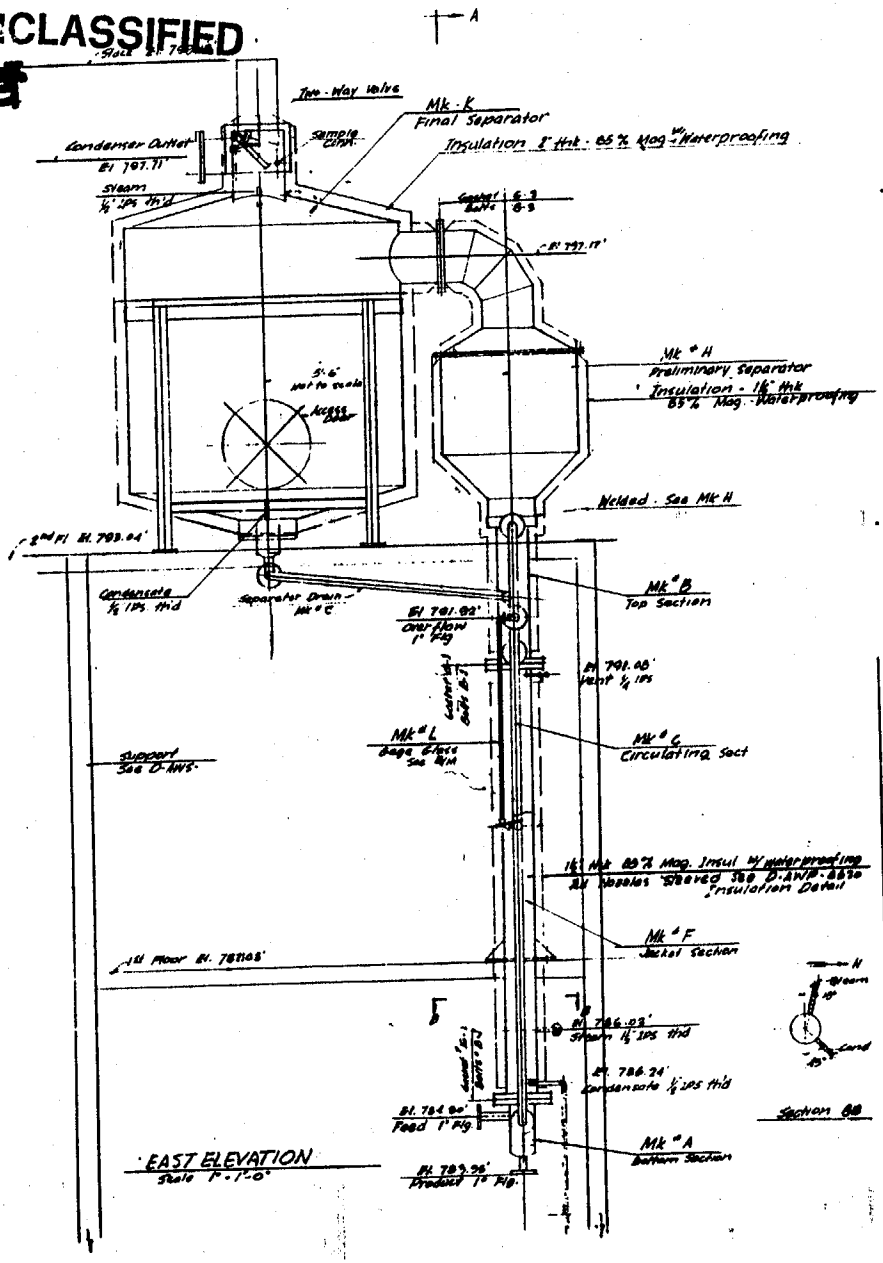

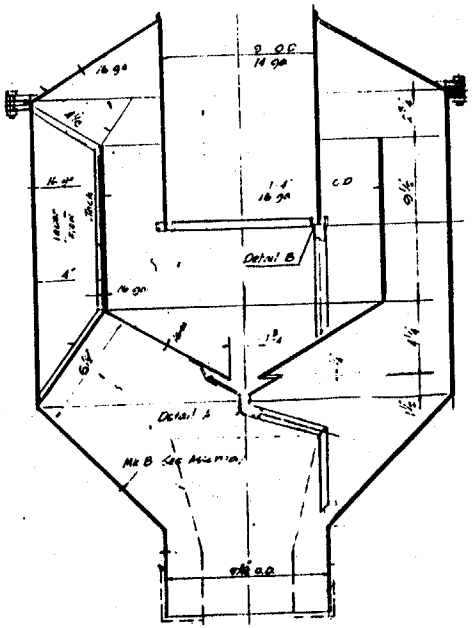

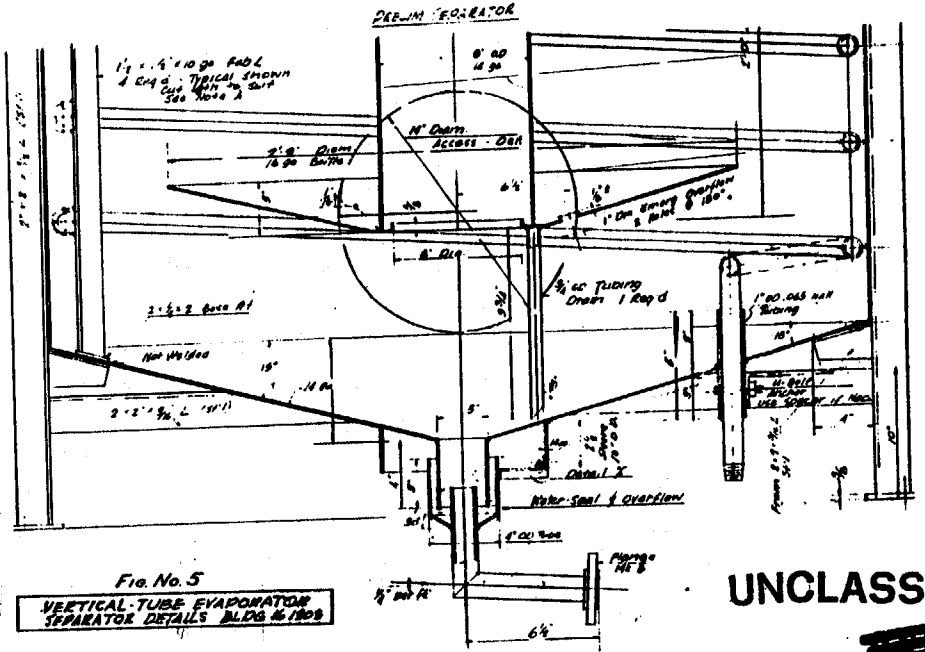

FIG. No. 5
VERTICAL-TUBE EVAPORATOR SEPARATOR DETAILS BLDG No 1809

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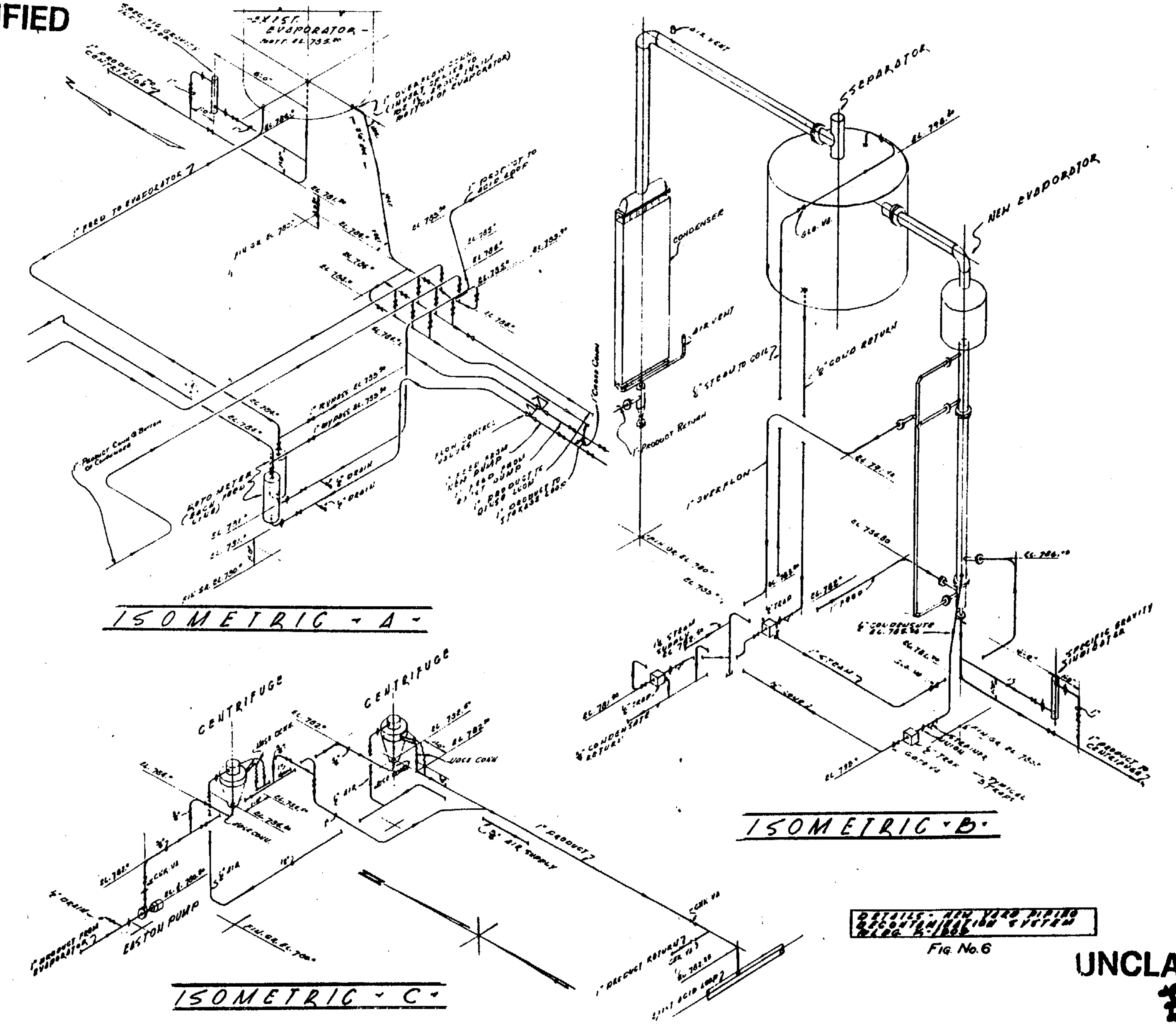

ISOMETRIC - A -

ISOMETRIC - B -

ISOMETRIC - C -

DETAILS - NEW YARD PIPING RECONCENTRATION SYSTEM BLDG.

Fig. No. 6

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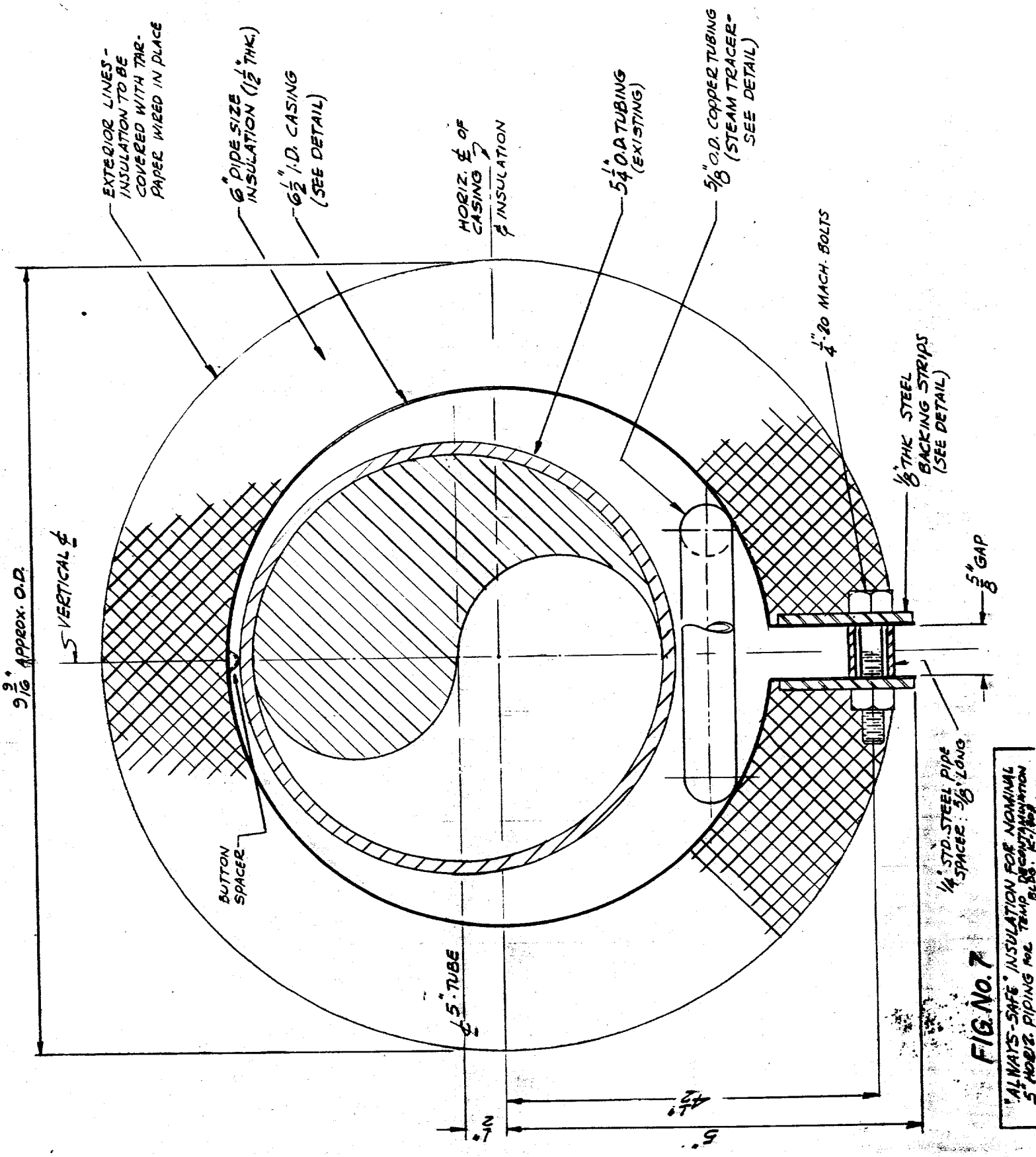

FIG. No. 7

"ALWAYS-SAFE" INSULATION FOR NOMINAL 5" HORIZ. PIPING AND TEMP. BLDGS. RECONSTRUCTION

ChemRisk/Shonka Research Associates, Inc., Document Request Form

2596

(This section to be completed by subcontractor requesting document)

J. Lamb / 1034A

Requestor — Document Center (is requested to provide the following document)

Date of request 2/16/96 — Expected receipt of document 3/16/96

Document number KS-37 — Date of document 3/28/49

Title and author (if document is unnumbered)

(This section to be completed by Document Center)

Date request received 2/22/96

Date submitted to ADC 2/26/96

Date submitted to HSA Coordinator 2/22/96

(This section to be completed by HSA Coordinator)

Date submitted to CICO 2/26/96

Date received from CICO 3/6/96

Date submitted to ChemRisk/Shonka and DOE 3/6/96

(This section to be completed by ChemRisk/Shonka Research Associates, Inc.)

Date document received

Signature

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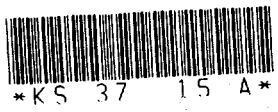
KS 37 15 A



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This document consists of 5 pages, No. 15 of 20 copies, Series A.

INTER-COMPANY CORRESPONDENCE

(Insert Name) COMPANY Carbide and Carbon Chemicals Corporation LOCATION Post Office Box P, Oak Ridge, Tennessee

TO Mr. J. P. Murray
LOCATION K-303-7

DATE March 28, 1949

APPROVAL LETTER NO. 55

COPY TO Dr. C. K. Beck, Mr. C. E. Center, Mr. C. B. Clifford, Mr. S. Cromer, Mr. A. P. Dunlap, Mr. A. P. Huber, Mr. W. B. Humes, Mr. R. G. Jordan, Mr. J. A. Marshall, Mr. D. H. Rader, Mr. S. R. Sapirie (AEC), Mr. M. F. Schwenn, Mr. H. G. P. Snyder, Mr. S. Visner

SUBJECT Decontamination and Uranium Recovery in Building K-1410

KS-37

M-40359

Introduction

A study of the special hazards involved in the installation of decontamination and uranium recovery facilities in the K-1410 building has been made as requested. These installations, proposed by the Process Engineering Department, are as follows:

1. Acid spray decontamination unit.
2. Ammonia recovery system.
3. Degreaser unit.

This document has been approved for release to the public by:
Technical Information Officer
Oak Ridge K-25 Site
Date

Equipment

Acid Spray Decontamination Unit

1. One decontamination tank with overflow 1½ inches from the bottom of the tank, (8 feet by 6 feet by 4 feet).
2. One centrifugal pump, (1½ inches by 10 inches in diameter).
3. One spray nozzle manifold. One spray hose.
4. One five inch "always-safe" bucket.

Classification changed to: UNCLASSIFIED (level and category)
ADC or ADD signature (first reviewer) 6/21/95 Date
ADD signature (final reviewer) 8/9/95 Date

Carbide and Carbon Chemicals Corporation Operating Contractor for the U.S. Atomic Energy Commission.

[redacted]

Classification changed to: (level and category)
ADC or ADD signature (first reviewer) Date
ADD signature (final reviewer)

UNCLASSIFIED

Ammonia Recovery System

1. One Holding Tank - 55 gallon drum - (22 inches in diameter times 33 inches in length).

2. One Digester Tank - 55 gallon drum (22 inches by 33 inches).

3. One Shriver Filter Press - 6 inches by 6 inches by 1 inch frame (Maximum of 12 frames).

4. One Shriver Duplex Diaphragm Pump, Model 00-A. Volume of pump is less than 108 cubic inches.

5. One Waste Withdrawal Tank - 55 gallon drum (22 inches by 33 inches).

Degreaser Unit

1. One (6 feet by 4 feet by 5 feet degreaser tank with overflow $1\frac{1}{2}$ inches from bottom of tank).

2. One steam heated manifold.

3. One pump, Eastern D-11 (6 cubic inches in volume).

4. One five inch overflow bucket.

Operations

Acid Spray Decontamination Unit:

This unit is similar to the Basic Spray Decontamination Unit previously approved.[1] Various types of contaminated equipment from all phases of the plant process will be handled by this system. The equipment will be disassembled, placed in the decontamination tank and sprayed with a solution of nitric acid. The equipment will then be transferred for washing to the water rinse tank of the existing basic solution decontamination unit in K-1410.[1] A maximum level of $1\frac{1}{2}$ inches of solution will be maintained in the spray unit. Daily control samples to measure the concentration of uranium complexes dissolved in the solution in the spray tank will be made. The sampling method is that formerly approved.[1]

When the sample analysis reveals a concentration of less than 1750 parts per million, the solution will be pumped directly into the 55 gallon holding tank in the ammonia recovery system. This concentration corresponds to 350 grams of uranium in the 55 gallon tank. Solutions having larger concentrations of uranium than 1750 parts per million will be placed in containers of such

1 Approval Letter No. 46 - Uranium Decontamination System - K-1410 - Author - M. C. Edlund

a volume that the total amount of uranium does not exceed 350 grams. Then, these solutions will be processed in the ammonia recovery system in "always-safe" batches.

Ammonia Recovery System:

The contaminated solutions are fed by gravity from the holding tank or are poured directly into the digester tank where they are steam heated. Solutions from the basic spray unit contain hydrogen peroxide, which is driven off by heating, and sodium carbonate which is decomposed with evolution of carbon dioxide. The solution is acidified and ammonia added to precipitate uranium out of solution as ammonium diuranate. The solution is then pumped through the filter press by means of a Shriver Pump, and recycled until the filtrate becomes clear. The gases produced (H_2O_2, CO_2, NH_3) are vented to the atmosphere by means of a duct containing an aspirator. Continuous air agitation of the solution during the recovery process is provided in the digester tank. Filtrate is collected in a 55 gallon waste drum and analyzed for uranium content. If the analysis reveals the uranium concentration to be above 0.5 ppm the filtrate is reprocessed. The filter cake is collected in 5 gallon pails and sent to the K-1303 Area for processing in the oxide furnaces.

Contaminated solutions from other sources may also be processed according to the above procedure.

Degreaser Unit:

Equipment bearing contaminated oil or grease from all phases of the K-25 Plant are to be processed in the degreaser unit. Depending on the type of oil present, different solvents are used. The oils and solvents are respectively as follows:

1. Hydrocarbon Oil - Trichlorethylene.
2. MFL - Carbon Tetrachloride.
3. C-2144 - Freon 113.

After the contaminated equipment is placed in the tank, the solvent is vaporized by means of steam heated coils and the vapor is kept in the tank with cooling coils placed around the vertical sides of the tank. The vaporized solvent condenses on the contaminated equipment, dissolving the oil. The condensate then falls to the bottom of the tank where the solvent is revaporized, leaving the uranium and oil behind. In addition, a spray hose manifold is included for direct washing of equipment. A maximum level of $1\frac{1}{2}$ inches of solution in the tank is maintained by an overflow outlet $1\frac{1}{2}$ inches above the bottom of the tank. The contaminated solution will be sampled and analyzed before removal from the degreaser. Depending on the analysis, the solution will be placed in various containers, the amount in each container being limited to 350 grams of uranium or less. The material will then be delivered to Coded Chemicals for storage.

Special Hazards Considerations

The acid spray unit and the degreaser unit meet "always-safe" size requirements since the liquid height in the tanks is less than 1½ inches. However, as the dimensions of the holding tank, the digester tank and the filter press in the ammonia recovery system exceed "always-safe" limits, the amount of uranium in each of these components must be limited to 350 grams.

The interaction of the acid spray decontamination unit, the degreaser unit, the ammonia recovery system and the basic spray decontaminati on unit have been calculated. The one inch and ½ inch lines are not included in the calculations, as the maximum amount of uranium in the lines is less than 10 grams. As the bottom of the acid spray, basic spray, water rinse, and degreaser tanks are in the same plane, these components form part of an "always-safe" slab and their interaction on each other need not be determined.

Component	Calculated Solid Angle (Steradians)	Allowable Solid Angle (Steradians)
1. Ammonia Recovery System		
Center of Filter Press	0.090	0.38
Center of Holding Tank	0.125	0.38
Center of Digester Tank	0.123	0.38
2. Center of the bottom of the basic spray solution tank	0.320	0.38
3. Center of the bottom of the acid spray solution tank	0.287	0.38

The solid angle at the center of the degreaser tank is less than the value obtained at the center of the bottom of the acid spray tank, for the system is further removed from the ammonia recovery unit.

Conclusions

The decontamination and uranium recovery processes in K-1410 appear to be safe provided the following operational procedures are enforced:

1. Contaminated solutions from the degreaser unit and the acid spray tank may be removed only after an analysis of the uranium concentration has been made. Then, according to the analysis, the solutions may be

placed in appropriate containers as follows:

Concentration of Uranium (ppm)	Containers
up to 1750	55 gallon drum
1750 to 3200	30 gallon drum
3200 to 19000	5 gallon bucket
Above 19000	"always-safe" bucket

2. Solutions from the acid and basic spray decontamination units may be piped directly to the ammonia recovery unit only if the analysis reveals a uranium concentration less than 1750 parts per million. This corresponds to 350 grams of uranium in the 55 gallon holding tank and digester. If the concentration is greater than 1750 grams, the solution may be placed in the appropriate container as indicated above, and processed in the ammonia recovery system in quantities not exceeding 350 grams of uranium.

3. The filter cake is to be removed in such a manner that the distance between the cake and the holding and digester drums is greater than 10 feet.

4. Care must be taken to maintain proper spacing between barrels of contaminated solution prior to processing in the ammonia recovery system or delivery to Coded Chemicals. The present practice of maintaining 10 feet between drums, edge to edge, is sufficient for no more than seven (7) 55 gallon drums or thirty-six (36) 30 gallon drums.

5. No more than one container of contaminated solution may be within 25 feet of the recovery or the decontamination equipment at any one time and this container should not be brought closer than 10 feet to any component of the equipment containing uranium material.

6. Constant flushing of the drains leading to the system in K-1410 is to be provided during operation of the decontamination units. This will reduce the probability of uranium material accumulating in the sewer system if leaks in the decontamination units develop.

M. C. Edlund

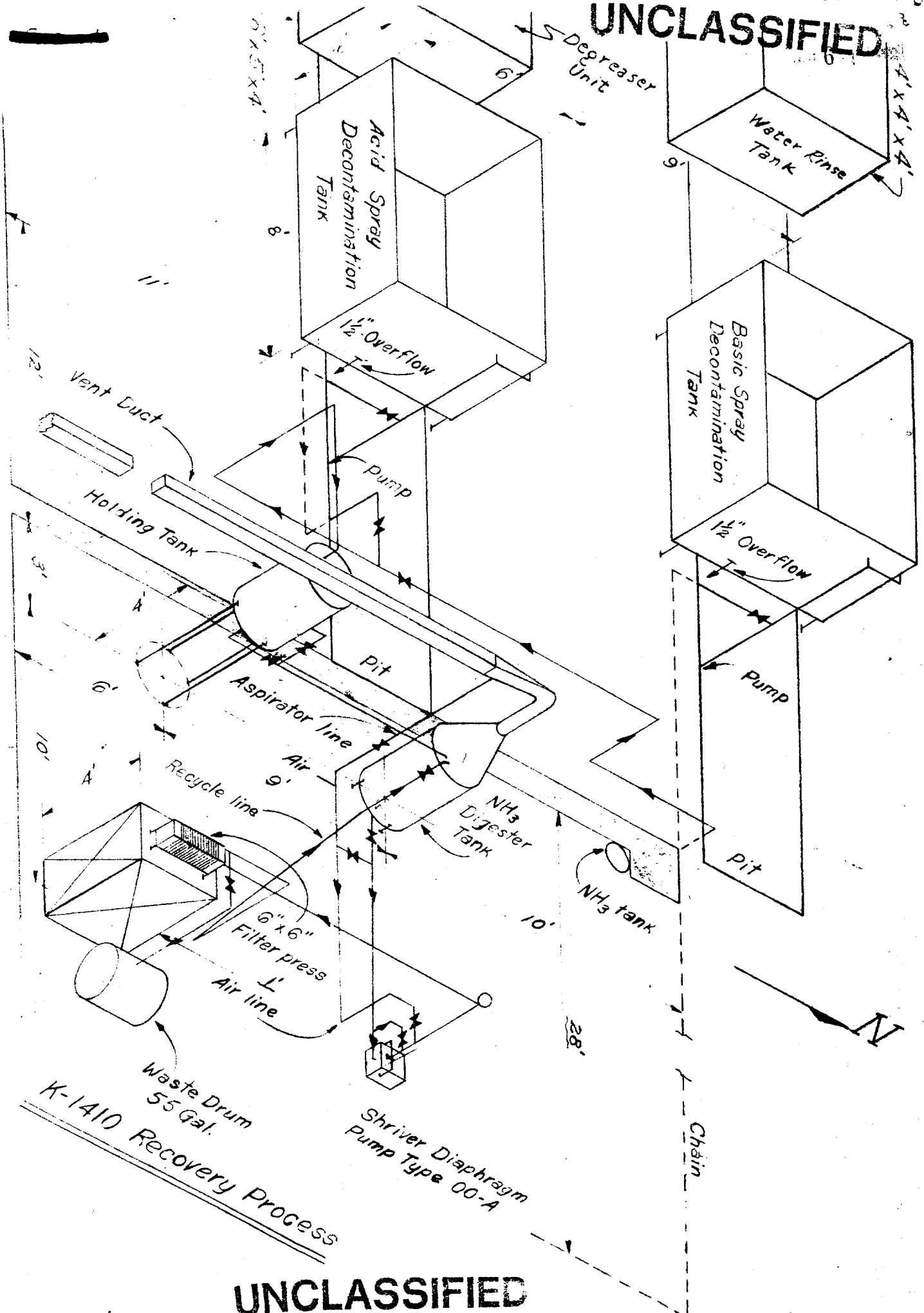
SV:MCE:lja

APPROVAL COMMITTEE ON RADIATION HAZARDS

C. K. Beck

S. Cromer

S. Visner


Degreaser Unit
Acid Spray Decontamination Tank
Water Rinse Tank
Basic Spray Decontamination Tank
1½" Overflow
1½" Overflow
Vent Duct
Pump
Holding Tank
Pump
Pit
Aspirator line
Air
Recycle line
NH3 Digester Tank
NH3 tank
Pit
6" x 6" Filter press
Air line
Waste Drum 55 Gal.
Shriver Diaphragm Pump Type 00-A
Chain
N
K-1410 Recovery Process

ChemRisk/Shonka Research Associates, Inc., Document Request Form

2597

(This section to be completed by subcontractor requesting document)

J. Lamb / 1034A
Requestor — Document Center (is requested to provide the following document)

Date of request 2/16/96 — Expected receipt of document 3/16/96

Document number KP-2030 — Date of document 8/24/60

Title and author (if document is unnumbered)

(This section to be completed by Document Center)

Date request received 2/20/96

Date submitted to ADC 2/21/96

Date submitted to HSA Coordinator 2/20/96

(This section to be completed by HSA Coordinator)

Date submitted to CICO 2/21/96

Date received from CICO 3/6/96

Date submitted to ChemRisk/Shonka and DOE 3/6/96

(This section to be completed by ChemRisk/Shonka Research Associates, Inc.)

Date document received

Signature

UCN-428
(1 1-59)

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This document consists of 2 pages.
No. 3 of 7 copies, Series A

~~K-5452~~ KP-2030

UNION CARBIDE INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX P OAK RIDGE TENNESSEE

To (Name) Mr. R. J. Clouse
Company
Location K-1420

Date August 24, 1960
Originating Dept. Production Engineering
Answering letter date

Subject Inventory of Uranium-Bearing Materials

Copy to Mr. A. L. Allen
Mr. J. W. Arendt
Mr. J. Dykstra
Mr. R. R. Frazier
Mr. S. S. Stief
File

KP 2030 3 A

KP 2030 3 A

CENTRAL FILES
REC'D M-23621
FILE
X-REF.

Attached is a summary of the inventory of some uranium-bearing materials as of August 1, 1960. These data were condensed from original information supplied by Mr. R. R. Frazier of the Uranium Control Section.

The value of the uranium is as uranium hexafluoride (not as contained uranium) and was obtained by multiplying the kilograms of uranium by the value of the uranium in dollars per kilogram U based upon the average U-235 content. The value of the uranium hexafluoride was obtained from the report "Standard Costs of UF_6 For The First Half of FY 1961", KD-824, July 29, 1960.

Soda lime, laboratory waste and chloride solutions, miscellaneous filter cake and sodium fluoride can be processed through the existing geometrically safe dissolver system without any expenditure for new equipment.

[redacted] 26Sep94
[redacted] 10/3/94

R. Paluzelle
R. Paluzelle

RP:jc

This document has been approved for release to the public by: A. S. Quist 6/22/94
Technical Information Officer
Oak Ridge K-25 Site

[redacted]
This Document Contains Restricted Data as Defined In The Atomic Energy Act of 1954. Its Transmittal Or The Disclosure of Its Contents In Any Manner To An Unauthorized Person Is Prohibited.

[redacted]
NO [redacted]
PLANT RECORDS FROM K-1037

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Union Carbide Nuclear Company, Oak Ridge Gaseous Diffusion Plant, Operating Contractor for the U.S. Atomic Energy Commission.

SECRET

Summary of Some Contaminated Materials in Inventory

Aug. 1, 1960

	Code	Assay Range					Totals
		Minimum to 0.999	1.000 to 1.999	2.000 to 3.499	3.500 to 4.999	5.000 and over	
Soda Lime	53						
Net weight, pounds		353	404	166	287	472	1682
Average Assay		0.780	1.174	2.819	3.651	10.619	—
Kilograms Uranium		22.20	12.45	10.24	12.05	14.26	71.19
Kilograms U^{235}		0.18	0.15	0.29	0.44	1.51	2.57
Approx. Value U as UF_6		₱734	₱854	₱2433	₱3,938	₱15,701	₱23,660
Chloride Sol'ns.	58						
Net Volume, gallons		317	1060	0	0	150	1,527
Average Assay		0.822	1.279	—	—	7.845	—
Kilograms Uranium		16.09	34.80	0	0	6.48	57.37
Kilograms U^{235}		0.131	0.445	0	0	0.509	1.085
Approx. Value U as UF_6		₱588	₱2,757	—	—	₱5,127	₱8472
Misc. Filter Cake	62						
Net Weight, pounds		3,628	7	231	50	9	3925
Average Assay		0.834	1.03	3.034	4.041	5.523	—
Kilograms Uranium		268.05	0.51	1.26	0.31	0.53	270.65
Kilograms U^{235}		2.25	0.01	0.04	0.013	0.029	2.335
Approx. Value U as UF_6		₱10,733	₱28	₱327	₱115	₱279	₱11,482
MFL Filter Cake	63						
Net Weight, pounds		499	543	1272	480	326	3,120
Average Assay		0.873	1.426	2.377	4.268	9.905	—
Kilograms Uranium		30.66	41.64	37.15	15.66	9.03	134.14
Kilograms U^{235}		0.221	0.594	0.883	0.669	0.894	3.261
Approx. Value U as UF_6		₱1255	₱3889	₱7058	₱6,171	₱9,214	₱27,587
Lab Waste Sol'ns.	64						
Net Volume, gallons		2727	820	505	227	144	4,423
Average Assay		0.817	1.564	2.618	3.983	7.755	—
Kilograms Uranium		113.81	17.01	9.05	1.18	0.25	141.29
Kilograms U^{235}		0.930	0.266	0.237	0.047	0.019	1.499
Approx. Value U as UF_6		₱4,097	₱1,817	₱1,959	₱428	₱191	₱8,492
Trichloroethylene	75						
Net Volume, gallons		84	51	8	0	0	143
Average Assay		0.760	1.500	3.317	—	—	—
Kilograms Uranium		6.01	2.14	7.81	0	0	15.95
Kilograms U^{235}		0.041	0.032	0.259	0	0	0.332
Approx. Value U as UF_6		₱188	₱215	₱2272	—	—	₱2,675
Filterings	78						
Net Weight, pounds		130	281	0	0	302	713
Average Assay		0.755	1.710	—	—	7.030	—
Kilograms Uranium		18.62	1.77	0	0	0.61	21.00
Kilograms U^{235}		0.140	0.032	0	0	0.039	0.211
Approx. Value U as UF_6		₱584	₱216	—	—	₱424	₱1,224
Undissolved Filterings	79						
Net Weight, pounds		2,090	1,964	4,634	1,200	645	10,533
Average Assay		0.934	1.518	2.800	4.350	8.170	—
Kilograms Uranium		135.56	27.58	38.33	19.32	6.61	287.40
Kilograms U^{235}		1.181	1.344	1.073	0.843	0.540	4.981
Approx. Value U as UF_6		₱6,276	₱9,005	₱9,000	₱7,730	₱5,462	₱32,011
Sodium Fluoride	84						
Net Weight, pounds		0	217	207	310	153	887
Average Assay		—	1.503	2.787	3.990	6.508	—
Kilograms Uranium		0	17.56	5.42	3.23	9.42	35.63
Kilograms U^{235}		0	0.264	0.151	0.129	0.613	1.157
Approx. Value U as UF_6		—	₱1,771	₱1,268	₱1,174	₱6,042	₱10,255

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Total Kilograms U = 1034.62

Total Approx. Value U as UF_6 ₱125,858